TOOLING & PRODUCTION

JULY 1958

The Opportunity of Obsolescence
Marvin J. Barloon 9

Transfer Line for
Railroad Wheels 41

Pushbutton-Controlled Storage . . 44

Volume Production of
Anodized Meter Parts . . . 120

Platform Loading Simplified . . 120

Don't Add Welding Wire —
Roll Planish
Harlan L. Meredith 122

New Roto-Flo Spline Rolling . . 127

Production Check of Surface
Roughness 127

Inspection at Loading
Station of New Machine . . . 129

Machine Speeds Layout,
Inspection 130

Departments in this Issue
Book Reviews 66
Products on Parade 72
Publication Previews 96
Shop Aids 110
Business Management Aids . . 112
Manufacturing Memos . . . 116
Coming Events 118

Recession: Action vs. Talk
by E. Willard Pennington **33**

The Behavior of Sliding Bearings
by R. A. Langdon
Whether user, buyer, or builder, it's important to know these principles of sliding surfaces **38**

Press Operator Safety
by A. B. Huntington and W. E. Hoffman
No hot air . . . but an explanation of how compressed air can boost press safety . . **42**

Optical Inspection of Intricate Contours . . 45

4 Progressive Die Jobs Save Time and Money
by Herbert Chase
See how Buick uses double-crank dieing machines, and saves **46**

Prime Examples of Cold Bending
by B. F. Bower
Accuracy, economy, and strength are reasons — and good ones — "cold" wins out over "hot" bending **48**

Maintenance of numerically-controlled equipment isn't so tough . . . IF you start off with a training program like Charles E. Johnson describes on page 35.

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1

We buy Sutton collets and feeders because they run true and hold true; Sutton's modern and exclusive method of heat-treating assures uniform temper and tension!

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We buy Sutton collets because they have the famous "Diamond Grip" serrations which grip tighter, reduce spoilage and clean themselves!

3

We buy Sutton collets because they are precision ground inside and out; they are properly hardened, drawn, and stress relieved; and, their accurate threads give true alignment!

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We buy special work-holding devices from Sutton because: Sutton designs to our needs; Sutton has the facilities to hold to tolerances and produce at scheduled deliveries; Sutton gives us items at competitive prices.

The Source For **ALL** *Work-holding Devices!*

RUNS AS TRUE AS THE SPINDLE

Sutton Tool Company
Sturgis, Michigan

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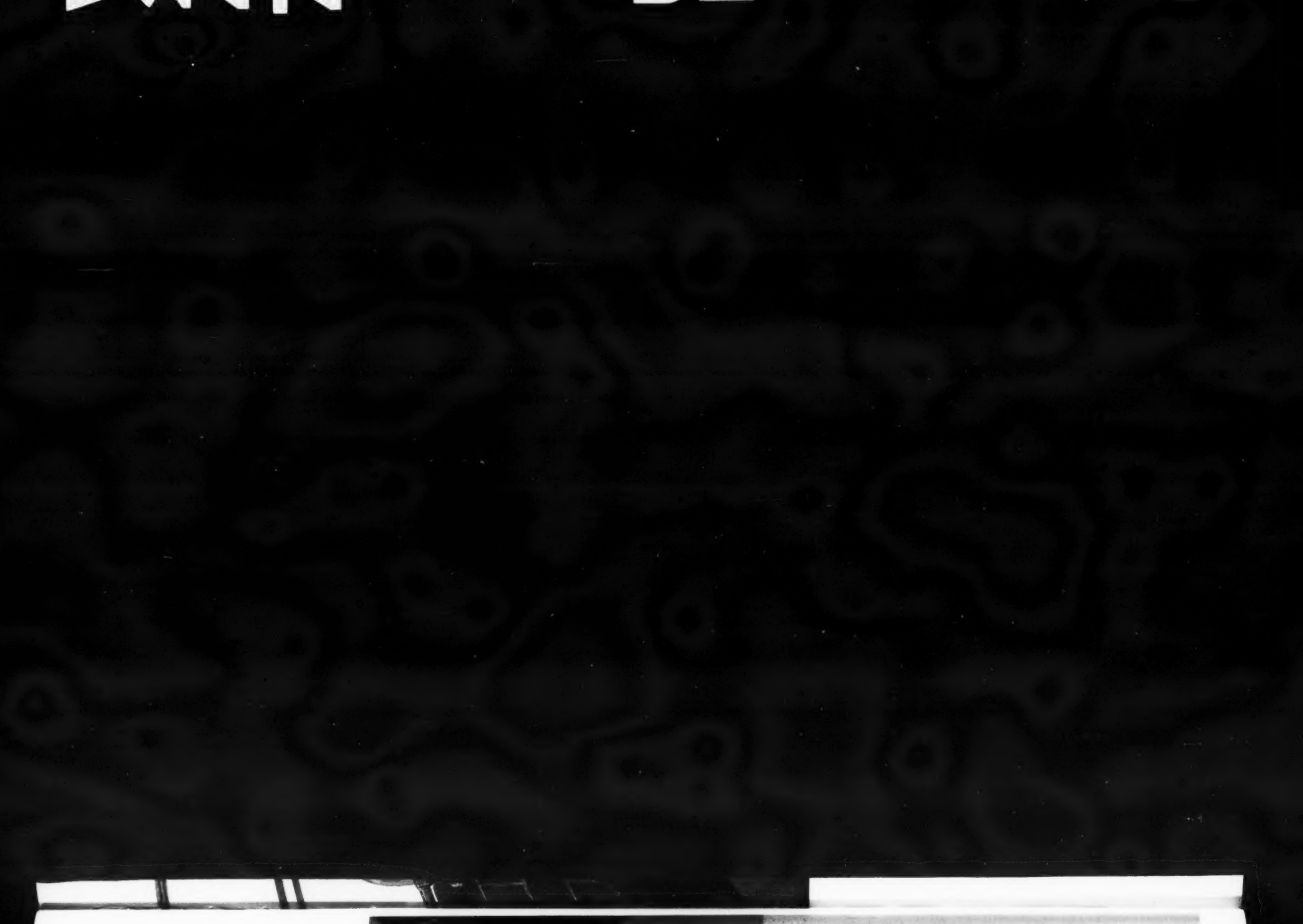

"I get 1200 parts a minute from each of these presses...

...all day long!" And production like that continues day in, day out. For Bliss High Production presses are especially designed for continuous high speed operation. Counterbalanced shaft, massive tie rod frame... square gibbing... features like these add up to *enduring* speed. For ease of operation there's ample room in front and back for die setting and space *under* the press for tote boxes or stacking chutes. Naturally, if you use large quantities of stampings this is the press that makes them. You will, however, be surprised to learn, that H-P presses can be set up so quickly and efficiently that more and more firms are using them for short run work.

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SINCE 1857

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RESINOID DIAMOND WHEELS

The *Best* Diamond wheel ever developed

- U.S. DIAMOND'S PROVEN REVOLUTIONARY "PRESSURELOK"® Process increases Diamond holding efficiency by 300%.
- Positively no danger of heating or cracking carbide with the most rapid stock removal.
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CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

JULY 1958
VOL. XXIV No. 4
GEORGE J. HUEBNER, Founder

PERSONALLY SPEAKING

Dear T&P Reader:

Just recently, a really amazing paradox has come to my attention. Expansion of our economy has been continually dependent on consumer buying. Today, our crying need is for a resumption of consumer buying so that industry will have to resume production. Much effort is expended to stimulate consumer buying of what to industry would be capital goods. But, what about industrial buying? Exactly the opposite is true because industry has to capitalize most machine and equipment purchases for varying and sometimes over-long, periods of useful life.

All of this came rather forcefully to my attention as a result of some comments made by a machine tool builder. For the present he is finding a very hesitant market for his new machines, but he is doing a respectable amount of business on reconditioning old machines which he had originally sold new. The principal reason for buying his rebuilding services lies in the economics of the transaction. A new machine has to be capitalized, but often at least some of the costs of reconditioning an old one can be expensed.

If there is any value in new designs, certainly reconditioning is not the answer to improving the efficiency of our over-all industrial plant. More equitable amortization rules for productive equipment would certainly help to stimulate new machine sales. New machines would modernize our productive plant and help to reduce costs of goods; lower prices of consumer goods would stimulate buying.

Meantime, if you are a plant-operating executive and you can't get a budget enabling you to buy new, standard machines that you know your plant should now have, perhaps you can get a budget for reconditioning some of your old machines. By all means, check with the builder of each machine to see how he can serve you in such a modernization program.

If you are a machine tool builder and are not now doing this type of work, perhaps it would behoove you to look into the opportunities it might afford. It's no secret that machine tool builders are short of orders. And a respectable volume of reconditioning work on machines you at one time sold new might be a great boon to you for the next six months or a year.

Meantime, users as well as sellers of new machines should continue efforts to get more realistic amortization rules. I'm sure we wouldn't have the standard of living in the United States that we have today if the consuming public had to buy as industry buys. It seems to me that this is a paradox that just simply should not exist.

Cordially yours,

Ray Huebner

Publisher

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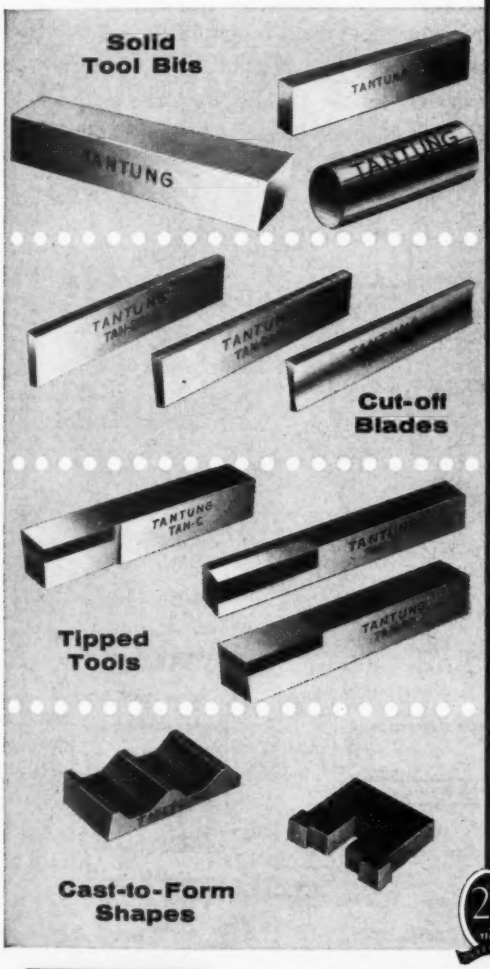
V-R TANTUNG Cast Alloy

is your best in-between* cutting tool material

*in-between

maximum speed for high speed steel and minimum speed for carbide



Here's what Tantung is. It is a cast alloy with high red-hardness, high transverse rupture strength, low coefficient of friction and high shock resistance.

TANTUNG bridges the gap between maximum cutting speeds possible with high speed steel and minimum speeds practical with carbides. Generally, TANTUNG can be started at speeds 50% higher than HSS and on many applications 100% higher.

Easily ground

TANTUNG is easy to grind, straight or to form, with aluminum oxide wheels. No diamond wheels required.

Lower tool cost

TANTUNG is available and stocked in solid tool bits, square, rectangular and round, permitting many regrinds, a variety of cut-off blades and tipped tools. Special shapes cast-to-form to your prints reduce grinding costs and insure longer tool life.

Many applications

TANTUNG will appreciably reduce machining costs on older machines which lack speed or rigidity to use carbide. TANTUNG is ideal for use on multiple operations where a wide variety of speeds are encountered.

SEND FOR LITERATURE

V-R Catalog

V-R Booklet—Where and How to Use Tantung Cast Alloy.

25 YEAR

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CIRCLE INFORM-A-GRAM KEY NO. 5

Produce Parts Like This In One Operation with BECHLER SWISS AUTOMATICS

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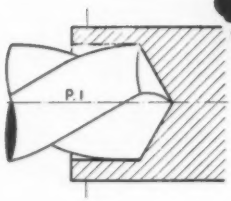
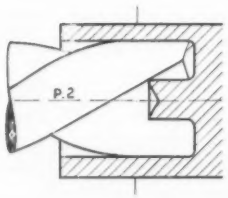
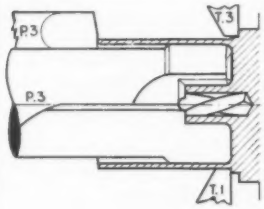


1 Rough drill–turret pos. 1.

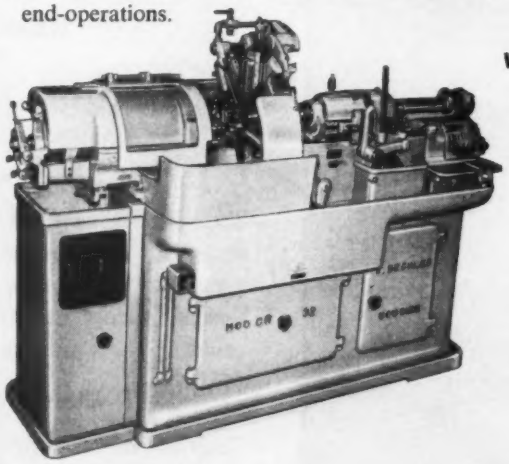


2 Rough trepan–turret pos. 2.



3 Finish trepan, drill, face-off–turret pos. 3; rough turn O.D.–tools 1 & 3.

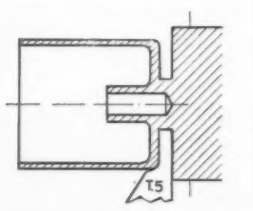
A Bechler CR-32 produced this intricate part from bar stock *in one operation.* Results were typical of Bechler performance: turning tolerances were held within .0005″, concentricity to .0005″, wall thickness within .0003″. Improvement over a previous multi-operation method was outstanding – lower costs, fewer rejects and a better finished product. Production of such parts is relatively simple with the Bechler's unique features – 5 cross slides (T) for the famous Swiss method of single point turning with carbide tools, 6 turret stations (P) for intricate, multiple end-operations.



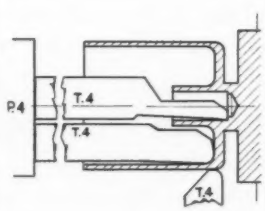
Write for Further Details

Bechler Model CR-32

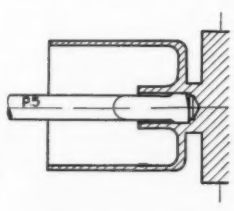
1¼″ diameter capacity • 9″ maximum turning length • gear driven headstock • 5 micrometer controlled cross slides • 6-spindle turret with hydraulic indexing.



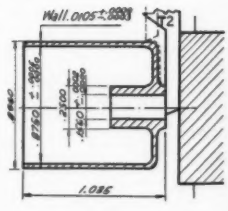
4 Rough cut outside end–tool 5.



5 Finish turn O.D. – tool 4; bore large & small I.D.'s – boring tools controlled by turret pos. 4.



6 Ream small bore–turret pos. 5.



7 Finish outside end (generation) and cut-off—tool 2.

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Service: – Bechler Service Corporation – 28 Harbor Street, Stamford, Connecticut

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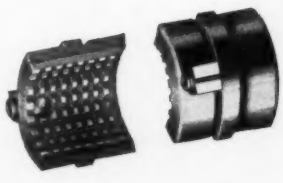
CIRCLE INFORM-A-GRAM KEY NO. 6

MORE

BALAS MARTIN MASTER COLLETS

are used by manufacturers and operators of automatic screw machines than all other types of master collets combined



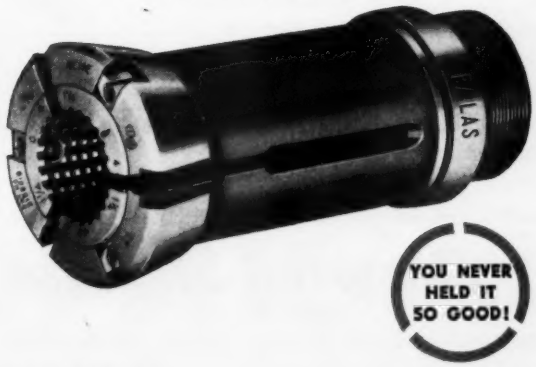
. . . because the Balas Martin Master Collet is the toughest, most rugged master collet produced today. It's front loading . . . permitting changing of the pads without removing the collet from the spindle . . . thereby saving hours of set-up time.

Martin Master Collets handle stock to the full capacity, consequently reducing costly collet inventory. Our superior manufacturing and inspection methods assure better performance and longer production life.

You can't lose when you buy from Balas. Satisfaction is guaranteed from any of our products or your money will be cheerfully refunded.

Solid and Master Pushers as well as Solid and Master Collets in most popular sizes for most machines are available for immediate delivery from stock. Write for catalog and price list.

BALAS
COLLET MANUFACTURING CO.
Cleveland 14, Ohio



CIRCLE INFORM-A-GRAM KEY NO. 7

DESIGNED to meet today's toughest demands

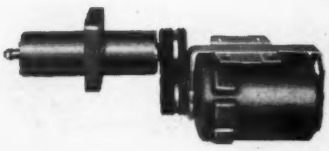
THE NEW BROWN & SHARPE No. 510 SURFACE GRINDING MACHINE

PRICED to meet today's equipment budgets

Tool and die shops, and other users of hand feed surface grinders, face increasingly tough demands today, — for high precision, for cost reduction.

The new B&S No. 510 Surface Grinder design is based on an extensive survey of these demands and needs. Add Brown & Sharpe's first-hand experience as tool manufacturing specialists, and you'll see why the new No. 510 provides the required plus in precision, work range, and efficiency.

THE LOW COST of the No. 510 is a welcome surprise to everyone who sees its many advantages demonstrated. Get details. Why settle for surface grinders of limited performance and capacity, when the same investment will buy the new No. 510? For full information, write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



"FULL POWER" ORIFLEX DRIVE

LAPPED TABLE ROLLERS

"ONE SHOT" LUBRICATION

GRADUATIONS READ TO 0.0002" on the Spindle Elevating Handwheel, and on the adjustable dial of the Crossfeed Handwheel, which provides close control of transverse feed.

FULL TRAVEL TABLE OF 11" is attained by moving the Table Lever only 180°.

"ORIFLEX DRIVE" to unit-type wheel spindle (left) is through five "O rings" from 1 hp motor in vibration-free mountings. The No. 510 is also available with a direct motor drive spindle.

RUGGED, CAST IRON spindle slide, upright, and table base distribute 95% of the machines' 1225 lb. weight above the heavy gage sheet steel base. Base cabinet provides liberal storage space for accessories.

TABLE glides on precision ground and lapped straight rollers (left) forming 90° "V" and flat guide ways — permits easy, smooth operation and preserves precision alignment.

"ONE SHOT" OILER (left) lubricates entire machine by depressing plunger.

MOVABLE SPINDLE UPRIGHT for crossfeed contributes to dependable precision slot and form grinding.

CAPACITY Grinds work 11" long, 5" wide, and 12" high with 8" dia. wheel . . . 12½" high with 7" dia. wheel.

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CIRCLE INFORM-A-GRAM KEY NO. 8

Talk of the Month

THE OPPORTUNITY OF OBSOLESCENCE

by Marvin J. Barloon
Professor of Economics
WESTERN RESERVE UNIVERSITY
Cleveland, Ohio

FROM TIME TO TIME we have heard that America has an aging population. Because of advances in medical science our manpower is getting older. But, it is not so often heard that throughout industry we have an aging population of machines. Our national stock of metalworking equipment is likewise getting older. In 1945, about 38% of all our metalworking equipment was over 10 years of age. In 1950, the figure had gone up to 43%. In 1953, it was 55%. In fact, nearly one machine out of five had just about reached voting age. Nineteen percent were over 20 years old — in 1953.

At present the staff of the *American Machinist* is preparing an updated "Inventory of Metalworking Equipment." I'll wager it will show the present stock of machines in American industry is at least as old as it was in 1953, and quite probably older. While our scientists are sending satellites into outer space, some of the shops which produce them are turning into Smithsonian Institutions.

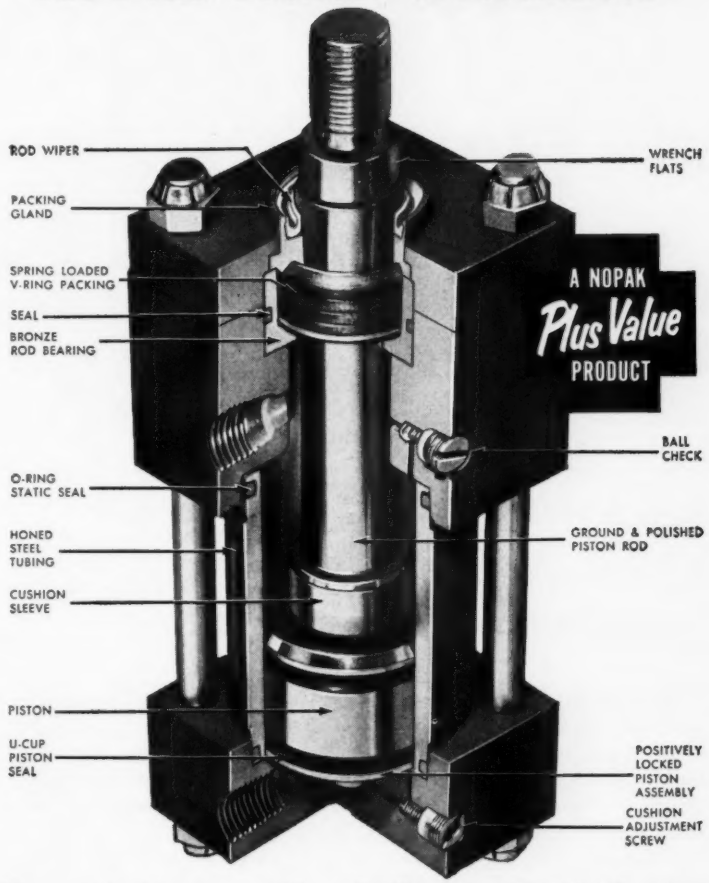
In recent years the backwardness of the industries of Europe and Great Britain has come in for a lot of unfavorable attention in this country. At the risk of seeming extreme, I am going to suggest that, in replacement policy, American management may be just as backward as European or British.

We look better, I know. The machines in our shops and plants are not usually as old as those in the factories abroad. Our average pro-

. . . Continued on page 10

Adapted from Professor Barloon's talk at Westinghouse Electric Corporation's recent 22nd Annual Machine Tool Electrification Forum.

POWERIZE with NOPAK
for Plus Value Performance



Class 3, Square Head Hydraulic Cylinders

Pressures 3,000 P. S. I. operating, 5,000 P. S. I. proof

Check these Class 3 Plus Values . . .

- Interchangeable with other well-known square head, hydraulic cylinders
- NOPAK Class 3 Cylinders comply with J.I.C. standards
- Positively locked, one-piece concentric piston
- Piston Construction . . . Self-compensating U-cup *(standard)* Multiple seal piston ring *(optional)*
- Expansion Joint Type Tube Seal † . . . Cannot extrude at excessive shock pressures Provides bleeder by-pass location at highest internal point † a NOPAK *first* since 1948
- Steel Construction for Strength and Durability . . . Heavy Honed Steel tube, Steel heads, High Tensile Steel piston rod and tie rods
- Multiple V-Ring Rod Seal and Wiper Requires no adjustment Assures longest possible trouble-free operation
- Cushion Adjustment Screw and Ball Check . . . Maintains minimum head dimension Identical seats provide interchangeability
- Bore sizes from 1½" through 12"
- 18 Standard mountings
- More power per dollar

Ask for Catalog 103 . . . It contains complete Data and Dimensions.

NOPAK VALVES and CYLINDERS

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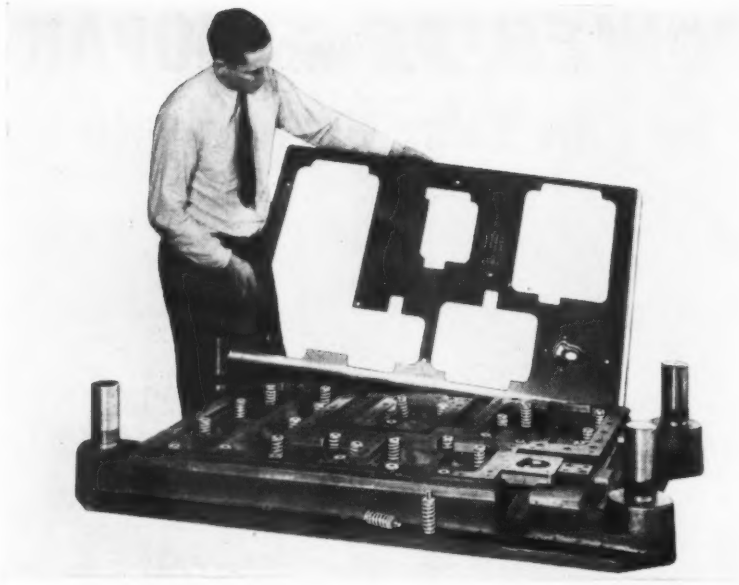

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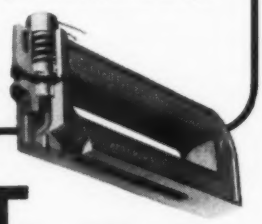
A REVOLUTION IN DIE-MAKING. The famous "Strippit," invented by Wales Strippit Company, saves tool engineers and die-makers endless hours of designing and building stripping mechanism into die sets. These compact, telescoping spring-and-retainer units provide standardized stripping pressures for uniform stripping of blanks from dies. Strippits eliminate spring grinding . . . stripper bolts . . . drilling and counterboring for stripper bolts . . . boring spring pockets . . . permit use of thinner, easier-to-machine stripper plates . . . eliminate turning over the punch holder and die shoe castings after the back sides have been planed. Strippits pay for themselves many times over on every job.

LOWER COST MULTIPLE PIERCING AND NOTCHING.

Strippit self-contained hole punching and notching units, provide the most economical way to notch up to ⅛" mild steel and punch flats, structurals and extrusions up to ¾" mild steel. These units are quickly set up in any pattern, placed in the press without loss of press time and actuated by the ram. Interchangeable standard or special tools . . . fast setup changes . . . re-usability of all units . . . give you high production plus flexibility for quick, economical design changes. Write today for complete engineering details and if you desire, a demonstration by a Strippit mobile unit at your plant. No obligation, of course.

Warehouse stocks in Chicago and Los Angeles.



A UNIT OF HOUDAILLE INDUSTRIES, INC.

WALES **STRIPPIT** COMPANY

212 Buell Road, Akron, New York

Manufactured in Canada by Strippit Tool and Machine Limited, Brampton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 10

. . . Month's Talk from page 9

ductivity is higher. But, for the most part, this is because our industries have been growing so much faster. During the past 10 years, the steel industry has expanded by 30%, the electric utility industry by 140%. The automobile industry has more than doubled. Naturally, the newer portions of our industries are stocked with more modern equipment. While we are growing fast, we look good. But when the rate of growth slows down, the residual accumulation of mechanical antiques in American factories begins to pull us down to foreign standards.

Not Replacing is More Costly

In the thinking of many American industrial managers there is a strong bias in favor of keeping in service any machine which is in good running order — any machine which will do the job. When you place before an industrial executive a proposal to replace an outmoded machine with a new model, what does he look at hardest? He looks at the high cost of the new model. In figuring a pay-off period he makes it short. He challenges the builder's salesman to prove that he ought to make the replacement. He does not ordinarily come up with replacement proposals of his own and make somebody else prove that they should *not* be made. He takes this for granted. In concentrating on the cost of replacement, he ignores the cost of not replacing.

Why is this? I think there are two probable reasons. One is the deep-seated habit of thought of regarding a machine as a way to make goods — not as a way to make money. We think too much of the shop as an engineering center. We concentrate on schedules, on specifications, and on tolerances. This is necessary, I know. But we don't see enough of the dollars and cents in the schedules, tolerances, and formulas. We tend to wall away our dollars and cents thinking in the front office with the people who don't see so much of the shop.

Probably another reason is that for such a long time this has been a capital-poor country. We hung back from putting money into modernization because we were so hard pressed for money to put into expansion.

Let me give you some examples of this thinking. One executive tells me that he won't replace a machine which is in good running order unless the new model will pay for

. . . Continued on page 12

Here's What One Government Gage Laboratory Says about PIPE MACHINERY HILO SET PLUGS

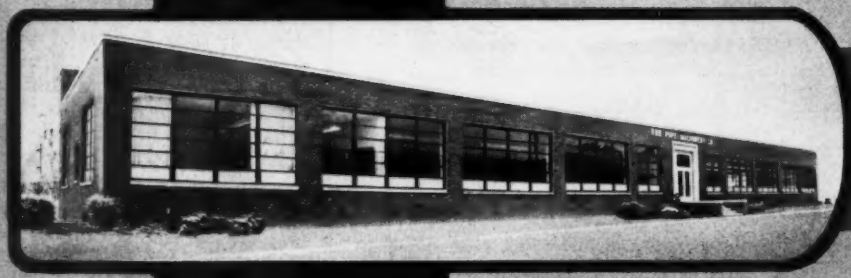
A well-known government gage laboratory recently reported on their study of our Hilo Thread Setting Plug Gages as follows:

"The setting plugs were used to retest several of the thread rings we had in stock. The results were enlightening. Some were rejectable because of worn flank; others were rejectable or borderline because of bell mouth.

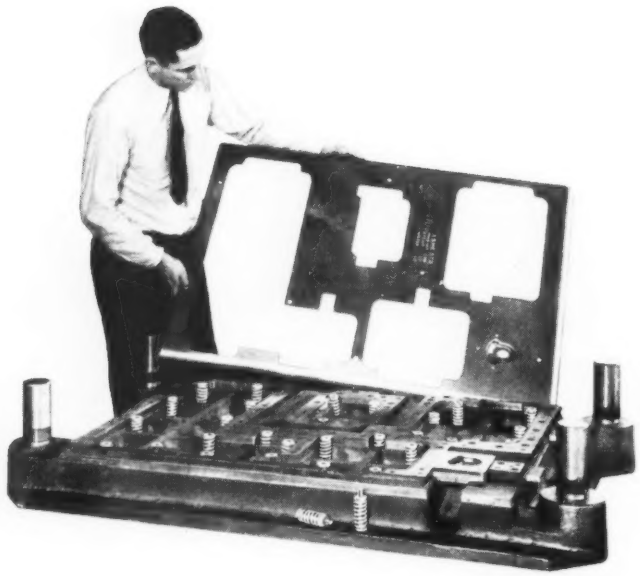
"The HILO Setting Plug is unquestionably sound and superior . . . a saving of many man hours by less skilled help for acceptance inspection and surveillance can be foreseen."

A word to the wise is sufficient. You, too, can employ no more positive method for setting your thread ring gages and other adjustable instruments for the inspection of male threaded parts than with Pipe Machinery Hilo Set Plugs.

Stop in and see us when you're in the Cleveland area.



THE PIPE MACHINERY COMPANY
Wickliffe, Ohio
Greater Cleveland



the **STRIPPIT** that gave us our name...brings you

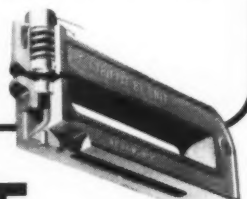
lower tooling costs!

A REVOLUTION IN DIE-MAKING. The famous "Strippit," invented by Wales Strippit Company, saves tool engineers and die-makers endless hours of designing and building stripping mechanism into die sets. These compact, telescoping spring-and-retainer units provide standardized stripping pressures for uniform stripping of blanks from dies. Strippits eliminate spring grinding . . . stripper bolts . . . drilling and counterboring for stripper bolts . . . boring spring pockets . . . permit use of thinner, easier-to-machine stripper plates . . . eliminate turning over the punch holder and die shoe castings after the back sides have been planed. Strippits pay for themselves many times over on every job.

LOWER COST MULTIPLE PIERCING AND NOTCHING.

Strippit self-contained hole punching and notching units, provide the most economical way to notch up to 1/8" mild steel and punch flats, structurals and extrusions up to 3/4" mild steel. These units are quickly set up in any pattern, placed in the press without loss of press time and actuated by the ram. Interchangeable standard or special tools . . . fast setup changes . . . re-usability of all units . . . give you high production plus flexibility for quick, economical design changes. Write today for complete engineering details and if you desire, a demonstration by a Strippit mobile unit at your plant. No obligation, of course.

Warehouse stocks in Chicago and Los Angeles.



UNIT OF HOUDAILLE INDUSTRIES, INC.

WALES **STRIPPIT** COMPANY

212 Buell Road, Akron, New York

Manufactured in Canada by Strippit Tool and Machine Limited, Brampton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 10

. . . Month's Talk from page 9

ductivity is higher. But, for the most part, this is because our industries have been growing so much faster. During the past 10 years, the steel industry has expanded by 30%, the electric utility industry by 140%. The automobile industry has more than doubled. Naturally, the newer portions of our industries are stocked with more modern equipment. While we are growing fast, we look good. But when the rate of growth slows down, the residual accumulation of mechanical antiques in American factories begins to pull us down to foreign standards.

Not Replacing is More Costly

In the thinking of many American industrial managers there is a strong bias in favor of keeping in service any machine which is in good running order — any machine which will do the job. When you place before an industrial executive a proposal to replace an outmoded machine with a new model, what does he look at hardest? He looks at the high cost of the new model. In figuring a pay-off period he makes it short. He challenges the builder's salesman to prove that he ought to make the replacement. He does not ordinarily come up with replacement proposals of his own and make somebody else prove that they should *not* be made. He takes this for granted. In concentrating on the cost of replacement, he ignores the cost of not replacing.

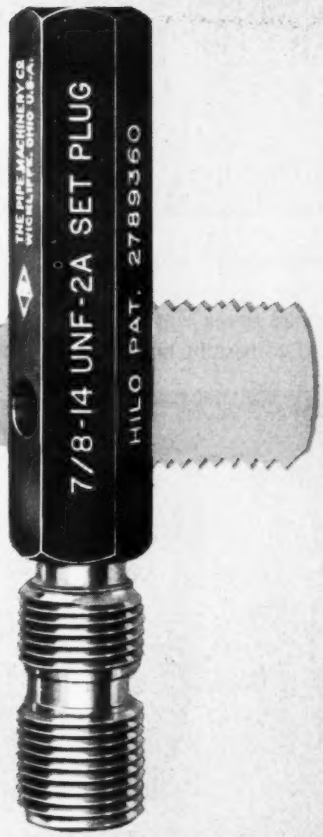
Why is this? I think there are two probable reasons. One is the deep-seated habit of thought of regarding a machine as a way to make goods — not as a way to make money. We think too much of the shop as an engineering center. We concentrate on schedules, on specifications, and on tolerances. This is necessary, I know. But we don't see enough of the dollars and cents in the schedules, tolerances, and formulas. We tend to wall away our dollars and cents thinking in the front office with the people who don't see so much of the shop.

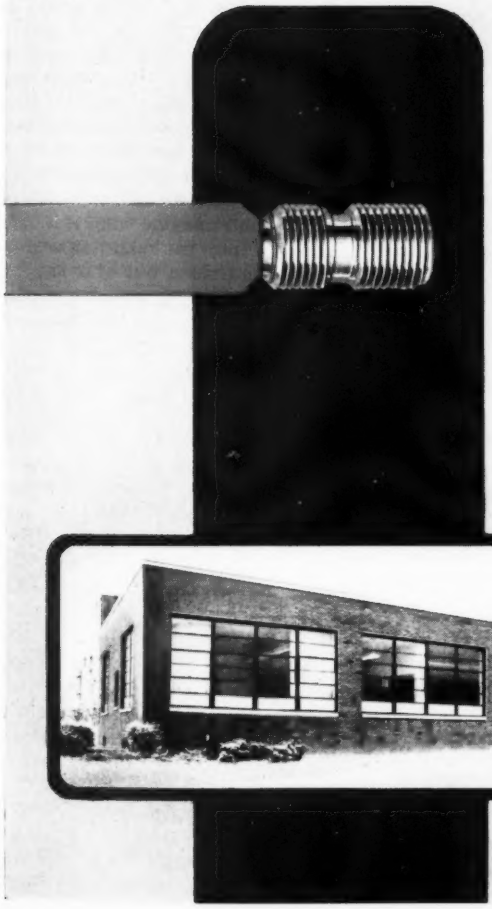
Probably another reason is that for such a long time this has been a capital-poor country. We hung back from putting money into modernization because we were so hard pressed for money to put into expansion.

Let me give you some examples of this thinking. One executive tells me that he won't replace a machine which is in good running order unless the new model will pay for

. . . Continued on page 12

Here's What One Government Gage Laboratory Says about PIPE MACHINERY HILO SET PLUGS





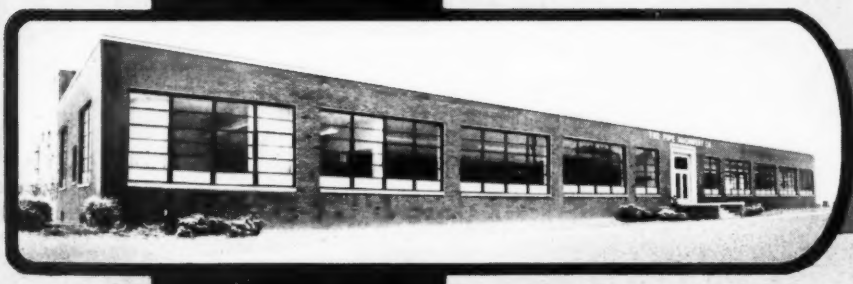
A well-known government gage laboratory recently reported on their study of our Hilo Thread Setting Plug Gages as follows:

"The setting plugs were used to retest several of the thread rings we had in stock. The results were enlightening. Some were rejectable because of worn flank; others were rejectable or borderline because of bell mouth.

"The HILO Setting Plug is unquestionably sound and superior . . . a saving of many man hours by less skilled help for acceptance inspection and surveillance can be foreseen."

A word to the wise is sufficient. You, too, can employ no more positive method for setting your thread ring gages and other adjustable instruments for the inspection of male threaded parts than with Pipe Machinery Hilo Set Plugs.

Stop in and see us when you're in the Cleveland area.

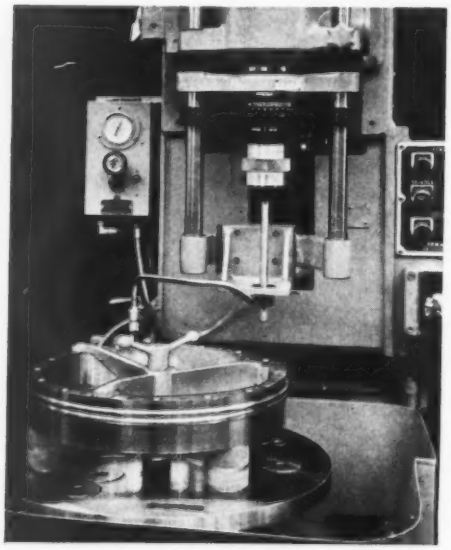


THE PIPE MACHINERY COMPANY
29100 Lakeland Blvd.
Wickliffe, Ohio
Greater Cleveland

CIRCLE INFORM-A-GRAM KEY NO. 11

WHY Pratt & Whitney MICROHONES Bores In Titanium Spacers

Rotor disc spacers, that are used in jet engines, require accurate bores having consistent surface finish. Thus, the final processing method must generate bores with diametric and geometric accuracies within .0005″ and consistent finishes of 15 microinches.



But, Pratt & Whitney Aircraft Division, U.A.C., faced additional problems in selecting the final processing method for these .110″ length bores in titanium spacers. Because the spacers are manufactured in 20 different heights and bores in two diameters, efficient production demanded extreme versatility of the processing method used.

Here's why Pratt & Whitney chose the Microhoning process and equipment to economically produce the required results: Microhoning, in removing .004″ of stock from each bore, accurately holds to size and finish requirements; and because the fixturing positions all 20 spacer heights at same work level, the tool stroke never needs adjustment. The Microhoning of all 16 bores in each titanium spacer is completed in about 7 minutes (including loading and unloading time).

Learn why Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ____ STATE _____ L

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 12

. . . Month's Talk from page 10

itself in two years. Why two years? There is no particular reason for this standard — except the fact that the earth revolves around the sun two times in this period. It is somethink like the old superstition about planting corn in the dark of the moon.

Replacement an Investment

Some firms don't use the payback method. They treat the proposed replacement as an investment and the savings which it may be expected to produce as a return on this investment. Some years ago the *Iron Age* quizzed 560 companies as follows: "If you would replace existing machine tools before they are actually worn-out physically, how much saving in percent of cost of new machine tools would have to be shown to induce their purchase?" Fourteen percent of these firms said they would be satisfied with a return of 15% or less. But, 17% of them wanted 50% or more.

Now, of course, we wouldn't expect these firms, each judging independently of the others, all to come up with anything like the same percentage. But, a spread all the way from 15% up to 50% is a pretty wide spread. In fact, a lot of them said they would be willing to replace for a return as low as 10%. But some others wouldn't replace for a return of less than 100%. If there is any rational standard which will yield results as far apart as these, I can't imagine what it is. The standards they use might as well be pulled blindfolded out of a hat.

Another example. Some time ago I was talking to a railroad executive about his "piggyback" service, the practice of carrying freight in highway trailers mounted on flatcars. He was using ordinary flatcars, which would carry only one trailer each. This means a very small payload for the dead weight of the flatcars. Furthermore, the tie-down gear on the flatcars was rather makeshift. It took a crew of five men about five minutes to secure each trailer. There are on the market specialized two-trailer flatcars and automatic tie-down devices which can be operated by one man.

I asked him why he didn't use these. He said something like this: "We are not a rich railroad. When you ask me why we don't use this high-cost and specialized equipment, it's like asking a man on a small income why he doesn't buy a Cadillac." He has there the formula for keep-

ing costs high and perpetuating its poverty.

Same Problems at Home

Suppose, now, this executive went home from work in the evening and his wife wanted to buy one of these new automatic kitchen ranges. It would be a great convenience, she says. It has two ovens, so you can bake two things at once — at different temperatures. Besides, the ovens are automatic. A housewife can put a roast in one of them in the morning and set the oven to go on at 425° at three p.m., to hold this temperature for 20 min., then to drop the temperature to 350°, hold this for two hours, and then be turned off. When she comes home from the bridge party, dinner is ready.

The man says: "How much does this dream-cooker cost?"

"They're practically giving them away," she says. "I found one today at Glotz's — a regular $1,200 value which they're willing to let me have for only $895."

"Well, now — we ought to think this over pretty carefully. It's like asking a man on a small income to buy a Cadillac."

But, suppose the next evening when he comes home, she has a new proposition. "Herb," she says, "I've been thinking of going to work again. The children are pretty well grown up and don't need me much any more. I used to make quite a lot of money selling real estate, and I bet I could do it again. The way things are now, I might be able to pick up five to ten thousand a year. I really get fed up with nothing to do all day."

Herb thinks this is a pretty good idea.

But, at this point, the wife gets reflective. "Of course," she says, "there would be expenses. I'd need more clothes. And, coming in late from work in the afternoon it would be hard going to get a dinner together. We'd have to eat out more often, and that costs money."

Herb picks it up from there. "Don't forget that range," he says. "You could put the complicated part of the dinner into it in the morning, set it, and when you came in late in the day everything would be ready."

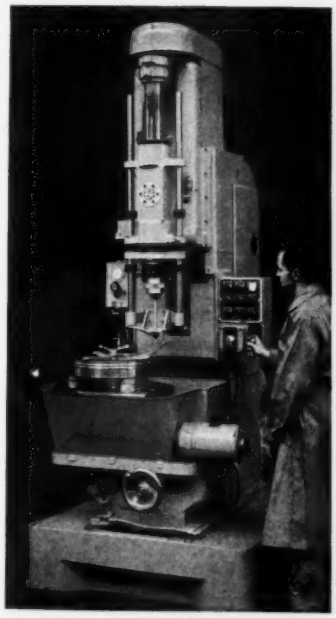
Now, you see what's happened. This man has stopped thinking of the range as a way to cook dinner and has started thinking of it as a way to save money — even to make

. . . *Continued on page 16*

HOW Pratt & Whitney MICROHONES Bores In Titanium Spacers

By Microhoning the bores in rotor disc spacers used in jet engines, Pratt & Whitney obtains final stock removal that efficiently produces close diametric and geometric accuracies (within .0005″) and consistent surface finishes of 15 microinches.

Here's how a Hydrohoner produces these accurate results in 20 different sizes of titanium spacers . . . each spacer having 16 bores that are either .680″ or .590″ in diameter and .110″ in length.



The Hydrohoner is equipped with precise feed and sizing controls that automatically expand and collapse the tool, compensate for abrasive wear, and terminate the Microhoning cycle when required bore size is reached. Also, because fixturing is designed to position all spacers at the same work level, the tool stroke never needs adjustment.

A rotary indexing table automatically locates each bore under the spindle and stops the Hydrohoner when all 16 bores in each spacer are finished. A lateral indexing feature positions the fixture to accommodate various spacer sizes. In fixture change-over, no special tools are required for simple exchanging of four details, and the switch from one spacer size to another requires but a few minutes.

☐ Please send me your movie "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ L

MICROMATIC HONE CORP.
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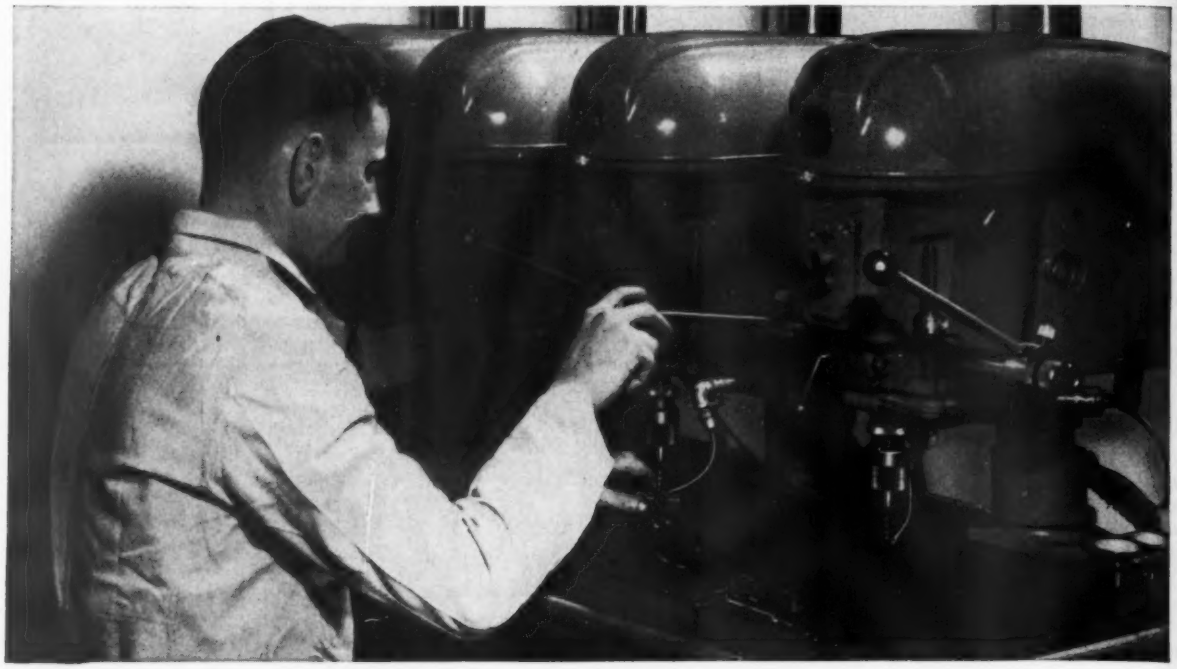
CIRCLE INFORM-A-GRAM KEY NO. 13

DELTA 15" DRILL PRESSES



67% Savings on Precision Drilling
of missile, electronic and instrument parts

DIAMETER TOLERANCES DOWN TO 0.0003 INCHES are maintained on some parts machined on Delta Drill Presses by Precise Products. Parts and jigs above show ingenious set-up required to achieve these consistently close tolerances. Stock may be stainless steel, brass, aluminum or beryllium—on runs as small as 10 and as large as 2,000 parts.

Changeover from former methods to use of this four-spindle 15" Delta Drill Press resulted in 67% savings for Precise Products, specialists in producing small, close-tolerance parts. And according to B. Lachowitzer, owner of this Minneapolis firm, "In one year the new drill press saved enough to pay for itself."

Four-spindle construction lets operator do multiple drilling on one run of parts at one sitting. The perfect alignment between spindles, columns and table on Delta Multiple-Spindle Drill Presses assures accuracy—eliminates time-consuming resetting. With constant flow of cutting oil, drill life is greatly extended, reducing down time, regrinding, and rechucking.

See Delta Drill Presses and a complete line of industrial metalworking tools and accessories at your nearest Delta Dealer . . . he's listed under "TOOLS" in the Yellow Pages. Choose from the WORLD'S MOST COMPLETE LINE of drill presses: 20", 17", 15", 14" and 14" Super-Hi Sensitive in floor, bench and overhead models.

FREE DELTA INDUSTRIAL CATALOG

Get all the facts on how YOU can cut costs with Delta Industrial Tooling—write: Rockwell Mfg. Co., Delta Power Tool Division, 622 G No. Lexington Avenue, Pittsburgh 8, Pa.

DELTA INDUSTRIAL TOOLS

another fine product by

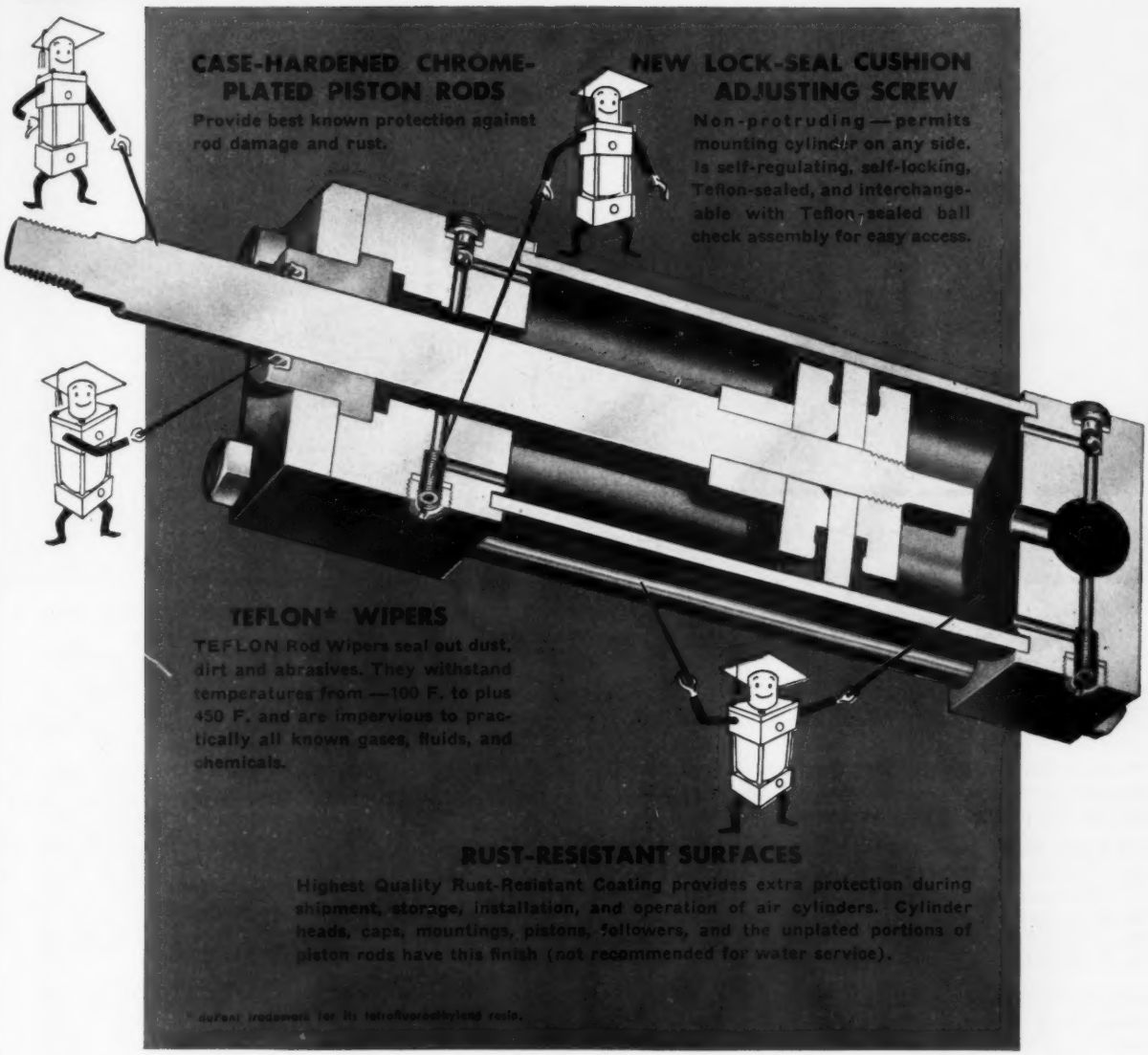
ROCKWELL

CIRCLE INFORM-A-GRAM KEY NO. 14

At No Extra Cost . . .

Miller AIR CYLINDERS

with EXTRA QUALITY Features!



CASE-HARDENED CHROME-PLATED PISTON RODS

Provide best known protection against rod damage and rust.

NEW LOCK-SEAL CUSHION ADJUSTING SCREW

Non-protruding — permits mounting cylinder on any side. Is self-regulating, self-locking, Teflon-sealed, and interchangeable with Teflon-sealed ball check assembly for easy access.

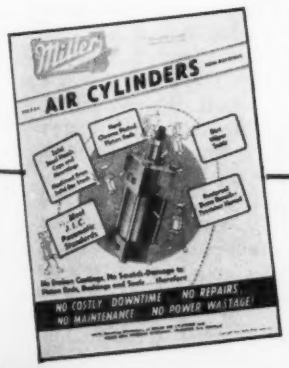
TEFLON* WIPERS

TEFLON Rod Wipers seal out dust, dirt and abrasives. They withstand temperatures from —100 F. to plus 450 F. and are impervious to practically all known gases, fluids, and chemicals.

RUST-RESISTANT SURFACES

Highest Quality Rust-Resistant Coating provides extra protection during shipment, storage, installation, and operation of air cylinders. Cylinder heads, caps, mountings, pistons, followers, and the unplated portions of piston rods have this finish (not recommended for water service).

*duPont trademark for its tetrafluoroethylene resin.



Other Standard Miller Quality Features include: bar stock steel heads, caps, and mountings; rust-resistant brass barrels; self-regulating, wear-compensating piston rod seals that never require adjustment; space-saving square design; and other features as shown in Bulletin A-105 sent free on request.

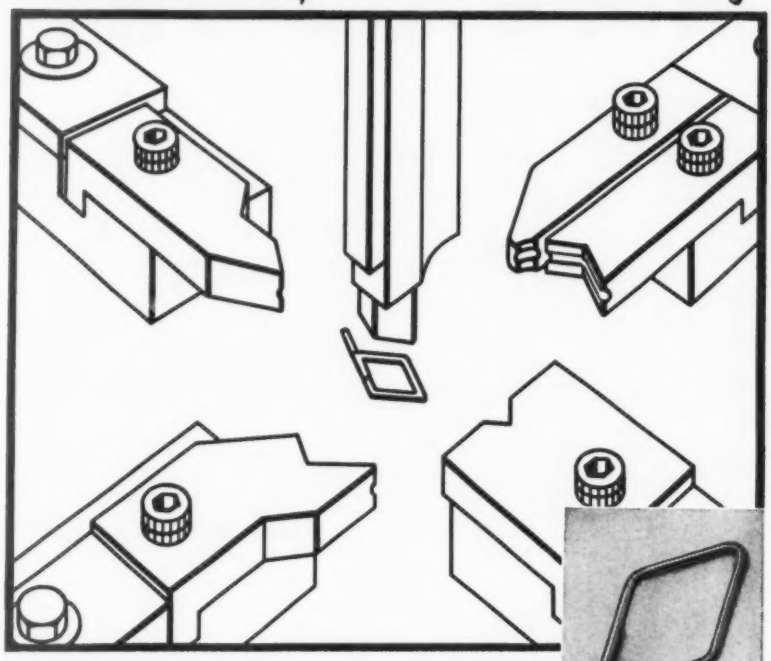
Sales and Service from Coast to Coast . . .

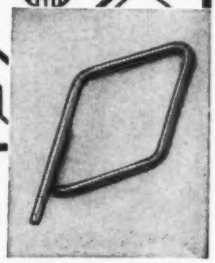
Miller Air Cylinders are available in 1½" through 20" bores for 250 psi operation. Select from 19 standard mountings, strokes up to 22 feet, single and double rod end, cushioned and non-cushioned, and over-size rod cylinders. Large selection for immediate delivery.

MILLER FLUID P[illegible]

2046 N. Hawthorne Ave., Melrose Park, Illinois

NILSON 4-SLIDES FORMING PRODUCTION PROFITS... *Automatically*





16,000 PARTS PER HOUR on a NILSON *Automatic* 4-SLIDE

PRODUCT: Deadlock Hook
MATERIAL: Soft Basic Wire
PRODUCTION: 280 Pieces Per Minute
MACHINE: No. S-0 Nilson 4-Slide

Whether your product is formed simply . . . or requires complex bending in several planes . . . a Nilson 4-Slide may be the solution to your production problems.

The sketch above shows the tooling used by a leading manufacturer to mass-produce metal hooks—at the rate of 280 pieces per minute! A Nilson 4-Slide has proved to be the most efficient, economical way to manufacture this product . . . and many other kinds of wire forms and small metal stampings.

Manufacturing costs must be kept down to meet today's competition. The combination of high speed and product uniformity—basic advantages of Nilson 4-Slides—means maximum production, minimum operating costs.

Before you design, tool, or specify manufacturing methods for your product, get in touch with Nilson. Over 60 years of experience with wire and metal forming applications can help you form better products . . . more profitably.

SIZE RANGES:
Wire up to ½" diameter
Ribbon stock to 3½" wide
Feeds up to 32"
5 TO 75 TON PRESS SECTIONS

NILSON
THE A. H. NILSON MACHINE CO.
1503 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

CIRCLE INFORM-A-GRAM KEY NO. 16

. . . Month's Talk from page 13

money. He can now size up the range as a dollar outgo balanced against a dollar income, and stop talking about Cadillacs.

In his conception of "piggyback" equipment, this executive had been thinking like too many other industrialists. He viewed a question of modernized railroad equipment just as the husband viewed the question of the kitchen stove as it was first proposed. He thought of the "piggyback" equipment as he would consumer goods. He considered operating advantages of this equipment as though they were conveniences. He thought of the range merely as a means of getting a dinner cooked. Likewise, he thought of a "piggyback" train merely as a means of transporting goods.

A factory is a place to make money. A new machine is not installed for its convenience, safety, accuracy, or speed. It is installed to cut costs or to increase income, like the kitchen stove for the wife who wanted to go to work. There are no Cadillac installations in a factory. Everything there is to produce income at the lowest cost. And the most expensive units may be the cheapest.

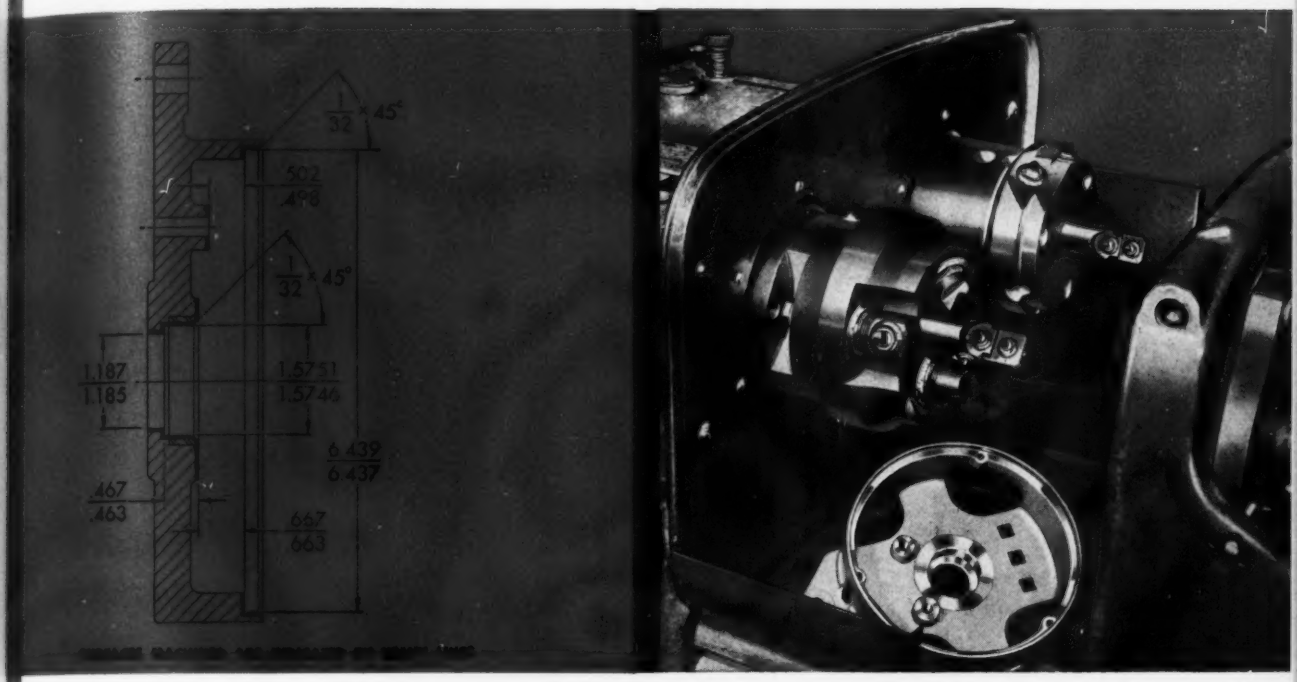
Guides to Replacement

Fortunately, inroads are being made in the old habits of thought which have retarded modernization for so long. For this we owe a great deal to the work of Dr. George Terborgh of the Machinery and Allied Products Institute (MAPI). In 1949, Dr. Terborgh came out with his Dynamic Equipment Policy, in which he presented what has come to be known as the MAPI Formula for determining the wisdom of a proposed replacement. Since that time he has prepared a number of other, shorter works designed to help plant executives in their use of his method.

Now, I don't mean to say that the MAPI Formula is the only way to make replacement decisions. Many of you are certainly familiar with this formula, and quite possibly some of you don't like it. If so, your reasons for not liking it may be good ones, and I suspect that the first one to admit this would be Dr. Terborgh, himself. But, there's this to be said: The MAPI Formula is a rational, dollars-and-cents investment calculation. It takes into account every important question bearing on the replacement. And, it leaves out of account everything ir-

. . . *Continued on page 20*

9 surfaces rough and finish machined in 2 passes...



HOW MICROBORE CLUSTER TOOLING DOES IT ON A PRECISION BORING MACHINE!

Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.

To find out how Microbore can help you, write for our new catalog No. 58.

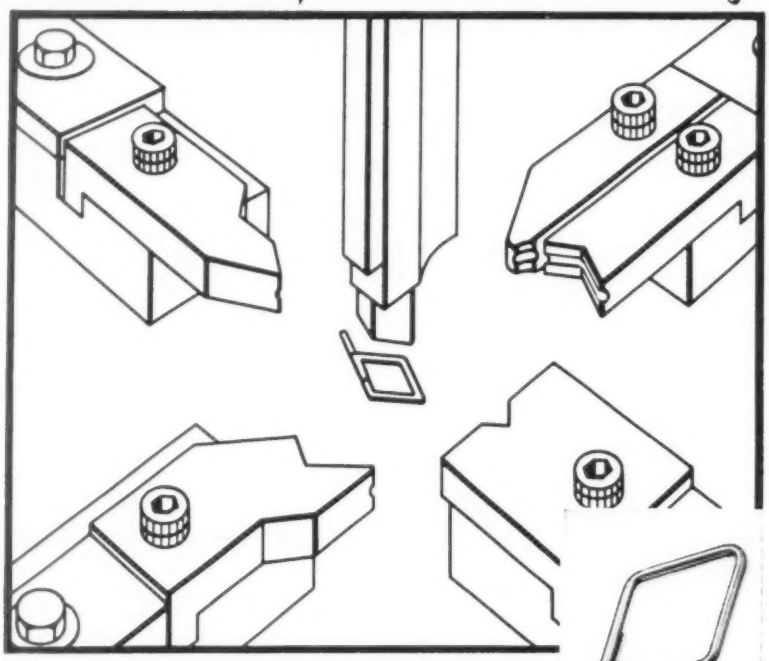
DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 17

NILSON 4-SLIDES FORMING PRODUCTION PROFITS... *Automatically*



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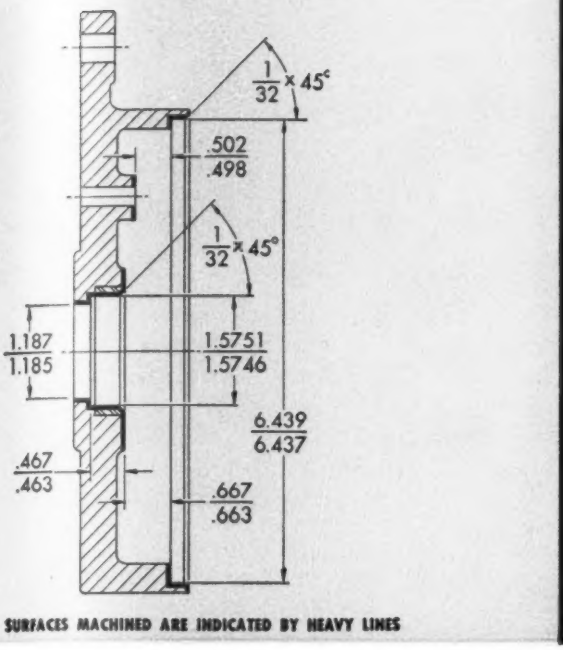
Guides to Replacement

Fortunately, inroads are being made in the old habits of thought which have retarded modernization for so long. For this we owe a great deal to the work of Dr. George Terborgh of the Machinery and Allied Products Institute (MAPI). In 1949, Dr. Terborgh came out with his Dynamic Equipment Policy, in which he presented what has come to be known as the MAPI Formula for determining the wisdom of a proposed replacement. Since that time he has prepared a number of other, shorter works designed to help plant executives in their use of his method.

Now, I don't mean to say that the MAPI Formula is the only way to make replacement decisions. Many of you are certainly familiar with this formula, and quite possibly some of you don't like it. If so, your reasons for not liking it may be good ones, and I suspect that the first one to admit this would be Dr. Terborgh, himself. But, there's this to be said: The MAPI Formula is a rational, dollars-and-cents investment calculation. It takes into account every important question bearing on the replacement. And, it leaves out of account everything ir-

. . . *Continued on page 20*

9 surfaces rough and finish machined in 2 passes...



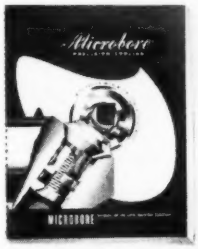
SURFACES MACHINED ARE INDICATED BY HEAVY LINES

HOW MICROBORE CLUSTER TOOLING DOES IT ON A PRECISION BORING MACHINE!

Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.



To find out how Microbore can help you, write for our new catalog No. 58.

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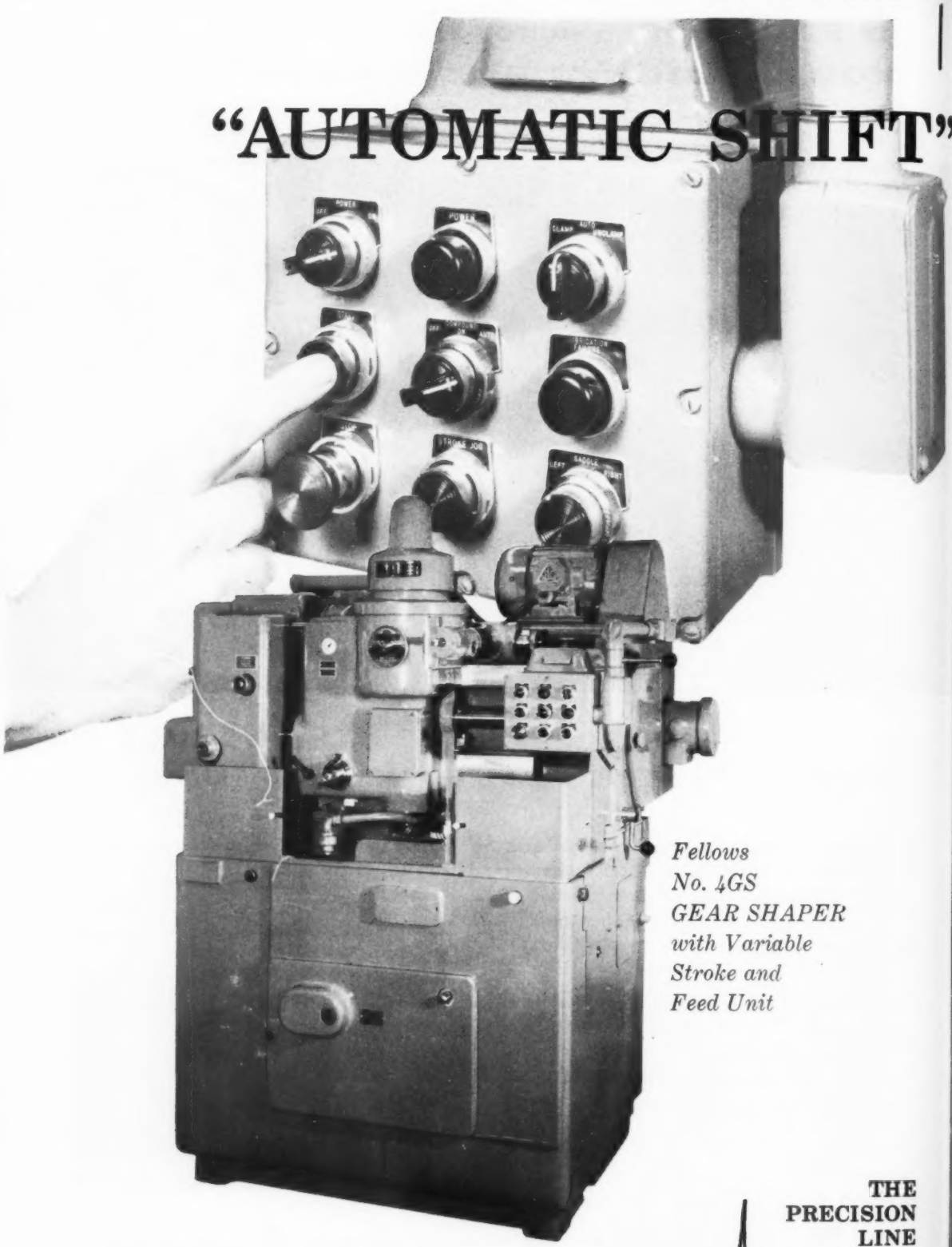
CIRCLE INFORM-A-GRAM KEY NO. 17

"AUTOMATIC SHIFT"



Fellows
No. 4GS
GEAR SHAPER
with Variable
Stroke and
Feed Unit

THE
PRECISION
LINE

changes Stroke and Feed

✓ Cuts production time...
✓ Lowers overall costs

Now . . . you can lower overall costs by using the Fellows No. 4GS Gear Shaper with the new, optional Variable Stroke and Feed Unit which *automatically* changes the rate of stroke and rotary feed between first and second cuts at any selected ratio within the speed and feed ranges of the machine.

With the Variable Stroke and Feed Unit the No. 4GS can make two cuts, and give you two-cut quality, in approximately the same time required for a single cut. There is no need to compromise on cutting speeds or feeds. Roughing and finishing cuts can be made at rates which are optimum for cutter and material.

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The Variable Stroke and Feed Unit is available as an optional unit on all Fellows No. 4GS Gear Shapers. The selector switches for this unit can be set to operate the machine as a standard Gear Shaper; to change *either* the strokes per minute *or* the rotary feed for the finish cut; or, to change *both* stroke and feed for the finish cut.

The No. 4GS provides nine cutter speeds ranging from 98 to 635 strokes per minute and rotary feeds ranging from 0.008″ to 0.028″ per stroke, based on a 4-inch pitch diameter cutter. Set-ups are easy and fast for internal or external, spur or helical gears, as well as cams, splines and other non-involute shapes up to 6″ pitch diameter and 2″ face width.

For full information, get in touch with your nearest Fellows representative. If you would like to have a 72-page booklet describing the Fellows No. 4GS Gear Shaper and its operation, just write to any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
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Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
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Fellows *Gear Production Equipment.*

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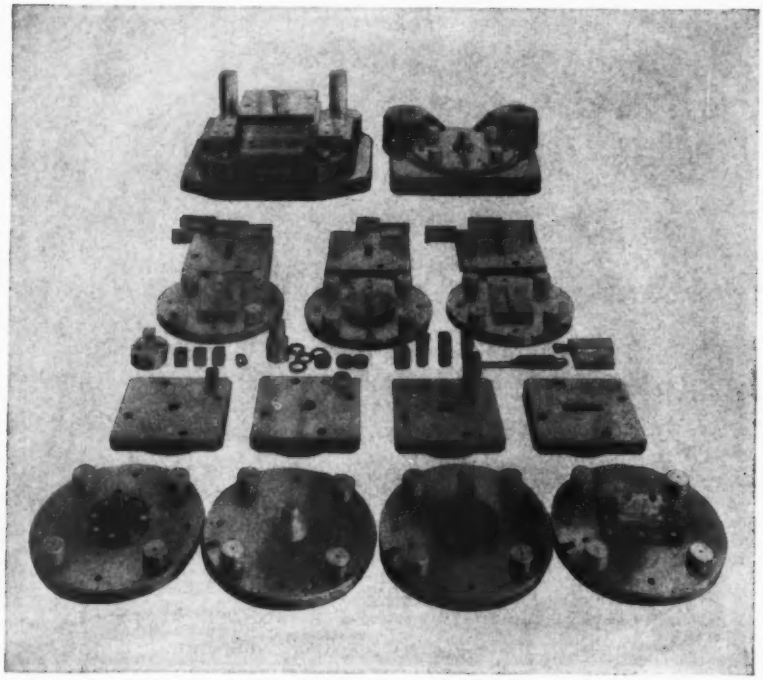

ALL THIS **FROM ONE BASIC DIE**

One basic die with 8 different sets of cutting members was used to trim the 8 parts shown. Some are round, some are square, some are rectangular and the one in the die is irregular. Depths vary from ¼" to 3". **Only one basic die is used.**

A Brehm "Shimmy" Die with angular cams can be designed for almost anything you need trimmed — fountain pen ferrules, artillery cases, watch cases, burial vaults, automotive, kitchen, radio and television accessories and parts. *Send part prints for quotation on Brehm "Shimmy" and related dies, such as blank, form pierce.*

THE SHIMMY DIE — VULCAN TOOL COMPANY — REGISTERED U.S. PATENT OFF.

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VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 20

. . . Month's Talk from page 16

relevant. It doesn't bias the figures for the replacement and it doesn't bias the figures against the replacement. The MAPI Formula balances the dollars the proposed machine will cost against the dollars it will save and gives you a calculated comparison on which a rational replacement decision can be based.

Another good method is the one which treats the replacement as an investment. Suppose, for example, that a proposed replacement would cost $10,000, installed, and would have a service life of 10 years. Suppose, also, that it will save an estimated $3,000 a year in operating costs. To get our $10,000 back over 10 years, we will have to regard $1,000 of this operating savings as a return of capital. This leaves $2,000 as income — a 20% return on the investment. The actual calculation, of course, is complicated by income taxes, and these will alter the picture a good deal. But, the basic idea is the right one. The machine *is* an investment, and it should be accepted or rejected strictly on the income it promises to yield.

But, is 20% enough or not enough? Here's where Dr. Terborgh's work bails us out again. He gives us a line on how to figure the cost of capital and to come out with a percentage return that makes sense. And it won't spread us all the way from 15% to 50%.

Replacement Benefits All Around

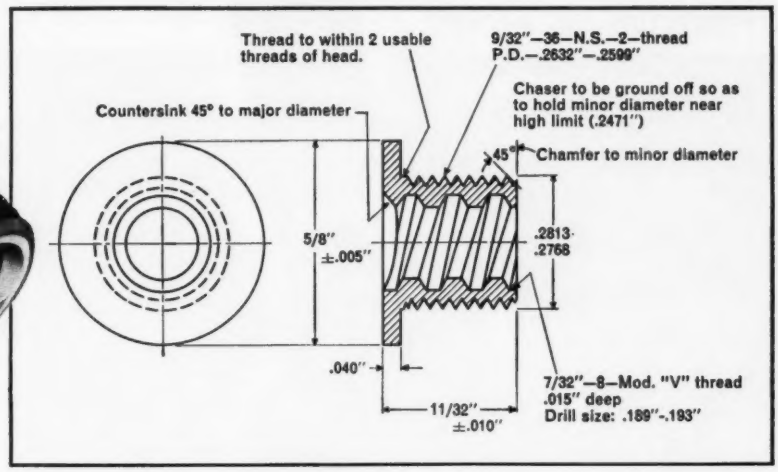
We bias our thinking against replacement in still another way. We look for the benefits of a replacement only in the one department — only at the actual work station where the new machine would be operated. A producer of housings for air conditioning units replaced a sheet-metal shear with a new one that would cut to greater precision. Precision saved relatively little at the actual work station; what it did accomplish was this — the truer cut of the sheet metal gave the design people a vastly wider latitude in designing the product for salability, and it gave the service people greatly improved access to moving parts. These benefits alone warranted the replacement.

A steel mill replaced a roll contour lathe with a new one costing some $40,000. The new lathe saved no money in the actual performance of the work. But, what it did accomplish was a finish with a shallower cut — from 0.013" down to 0.008" — and saved its price in a little more

. . . Continued on page 22

BETTER MACHINING STARTS WITH ALCOA SCREW MACHINE STOCK

Suppose you're handed this part to turn out...



Alcoa Aluminum will give up to 4 times higher cut-off feed

Operations in this flange bushing layout include internal and external threading with an extremely thin wall at the root of the threads. It's not an easy part to make.

But notice the high feeds with Alcoa® Aluminum Screw Machine Stock (2011-T3). Cut-off feed is .0042/rev—up to 4 times higher than with other materials. And the surface speeds: tap is 56.5 fpm; threading tool is 73 fpm; stock is 634 fpm.

So much for speed. What about quality? Alcoa Aluminum retains the surface finishes produced by machining—cut-off finish is superior. You can polish, buff, brush or burnish aluminum—and parts don't deteriorate in storage.

Convenience? Aluminum's light weight means easier handling, faster stock-up time. Because aluminum doesn't punish your tools, there's less downtime for maintenance. Aluminum means less heat—you can use lighter oils. Alcoa 2011-T3 gives top spindle speeds and fewer chip problems. Result: Lower Costs.

Find out more about better machining with Alcoa Aluminum Screw Machine Stock. Here's how to do it:

- Meet Tom Conroy, Alcoa's Screw Machine Specialist and field consultant. He will be glad to demonstrate aluminum's advantages. See coupon.
- Send for free book, *Alcoa Aluminum in Automatic Screw Machines.* It's a valuable procedures manual written for production men.
- Ask for immediate stock delivery by calling your nearest Alcoa sales office or Alcoa distributor.

MULTIPLE SPINDLE LAYOUT

PC. NO. V5-1248	**TIME PER PC.** 1495/hr.	**DATE** 4-8-58
MACHINE 1" N.B.—Mod. 60	**MATERIAL SIZE** 5/8" Rd.	**MATERIAL GRADE** 2011-T3
SPINDLE R.P.M. 3875	**CHUCKS** 5/8" Rd.	**FINGERS** 5/8" Rd.
SPINDLE GEARS 89-31		**FEED GEARS** 71-49
KIND OF THREADING SPINDLE N.B.		**RATIO** .255 **ON** .498 **OFF**
THREADING 990 **REV.**		**TOTAL USABLE REV./PC.** 74.3
SURFACE SPEED 634 Stock 73 Die 56.5 Tap **FT. PER MIN.**		**MIN. INDEX TIME** 1.18 **SEC.**

SEQUENCE OF OPERATIONS

OPERATION	RISE	LEV.	FEED	CAM NO.	TOOL	HOLDERS
1—Box .281" Dia.	.625		.0084	5/8	Pick-up Std.	# 22 B.&S. Box Tool
Center					Pick-up Std.	in above Tool
2—Drill .193" Dia.			.0084	5/8	4.9 mm Drill	# 14 B.&S. Floating
3—Recess			.0021	5/8	V5-1248	N.B. Recess Tool
4—Thread				V5-1248	9/32-36 NS-2 Chasers	# 101 H.&G. Die Head
5—Chamfer			.0084	5/8	Pick-up Std.	# 22D B.&S. Center & Face
6—Tap				V5-1248	7/32-8 Mod. "V" Tap	# 22F B.&S. Releasing Tap
Cut-off	.3125		.0042	5/16	1/4 Str. Blade Ground to .187"	N.B. Inside

REMARKS: 1/4" c/o Blade Ground to Break Down for Box Tool.

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Yes, I'd like to—

☐ Hear from Tom Conroy.

☐ Have a copy of *Alcoa Aluminum in Automatic Screw Machines.*

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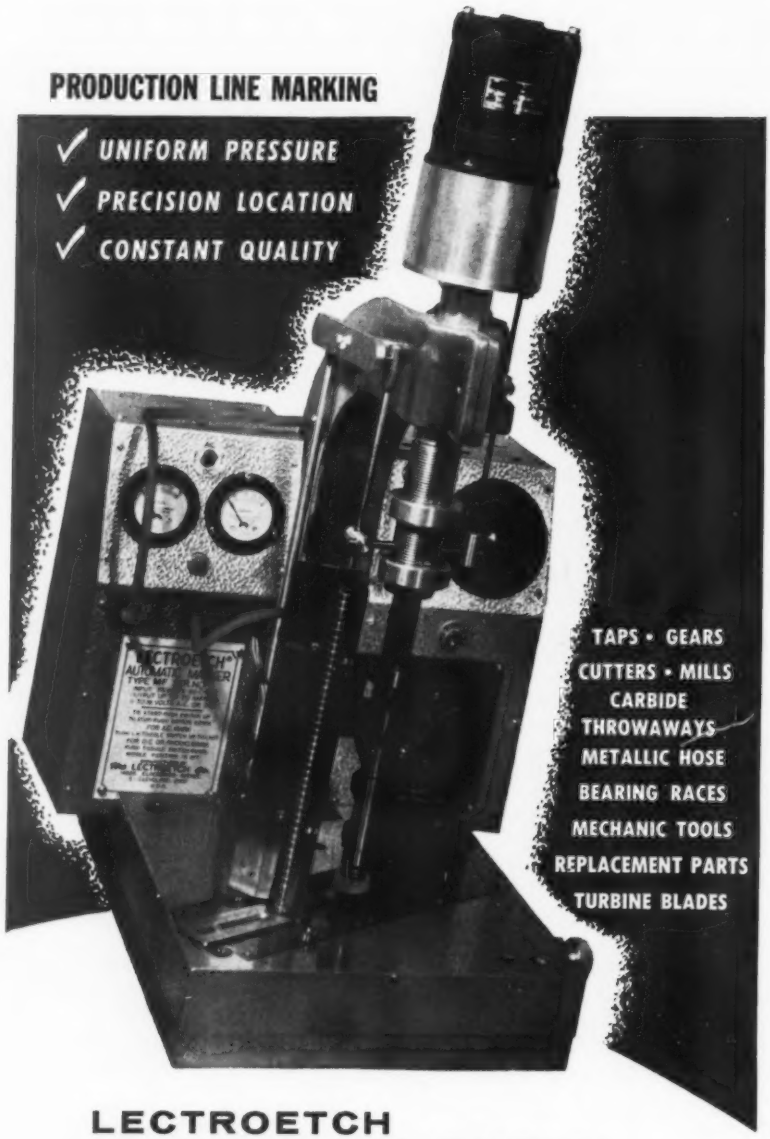

LECTROETCH AUTOMATIC MARKERS

Magazine • Index • Hand Feed

TRADE MARKS . . . PARTS AND MIL SPEC. NUMBERS

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- ***all commercial metals . . .*** electrolytic stencil etch method produces permanent mark.
- ***large or small . . .*** parts numbers as small as a fraction of an inch to 40 square inches of mark area.

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The* LECTROETCH® *Co.

14925 Elderwood Ave., East Cleveland 12, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 22

. . . Month's Talk from page 20

than a year in conservation of the chilled surface of the roll.

A precision bore may eliminate reaming; a burring attachment, a subsequent burring operation. Closer adherence to tolerances may save little or nothing either on inspection or rework costs right in the department. But, miles away, it may be worth its weight in gold if an assembled product goes through its paces in the running tests without having to be torn down for replacement of faulty parts.

Probably you have had the experience of seeing a replacement made by a close decision on benefit expectations narrowly calculated. And, when, after the new machine was in service for a while, have you been surprised at the many unexpected improvements it yielded — in product design; in service in the field; in the assembly room; or in the variety of materials you could feed into it with good results? If you have had this experience it should be a tipoff to look more widely in sizing up subsequent proposals. We miss the wide panorama of a replacement question if we look at it only through the keyhole of the departmental cost sheet.

Replacement Hits Newer Units

But, we should go even farther than this. I have been talking about the replacement of obsolete machines. But, sometimes the machine may be the very latest model — or as good as the latest for the job at hand — and still it ought to be replaced. This is when, not the machine, but the very process itself has become obsolete.

When a shop executive is given drawings and asked to go ahead with production plans, just as a matter of habit he proceeds with the long, familiar processes he has been following, and with the equipment he already has. Since the end of the war, however, we have seen some very fundamental changes in processes. Flame cutting, powder metallurgy, the use of extrusions, and precision casting are just a few of the more basic developments. The executive may have tried one or more of these processes five years ago and found it didn't work. But, today it might work. The metals industries have been developing new products, new shapes, new dimensions, and new alloys. These innovations might call for a machine replacement, not so much because the old machine is obsolete, but be-

. . . *Continued on page 24*

Firth Sterling ...

PIONEER IN POWDER AND MOLTEN METALLURGY

Your assurance of results...

your guarantee of genuine Firthite in your blue-print tools

When you specify Firthite sintered carbide for your important blue-print tools, you count on top quality and money-saving performance. Now, Firth Sterling, in cooperation with leading toolmakers, offers a guarantee of quality unmatched in the industry.

This exclusive new service is designed to help you get maximum efficiency in your metal removal applications. It is typical of the progressive thinking that has characterized Firth Sterling during more than 68 years of metallurgical pioneering.

CERTIFICATION: To assure you that the exact grade of Firthite you specify goes into the cutting tools you buy, the bright, new label shown above will appear on the shank of each tool. It certifies a product engineered and quality controlled from ore to the finished tool—tools that cut faster, stay sharp longer and reduce downtime for regrinding. Firth Sterling and most leading toolmakers have agreed to apply this label *only* on tools using genuine Firthite.

* * * *

Insist on the Firthite label when you order blueprint tools—your certification of grade and quality. For further information on Firthite sintered carbide, or help with *any* metallurgical problem write: Firth Sterling, Inc., Dept. 11G, 3113 Forbes St., Pittsburgh 30, Pa. Warehouses and offices in principal cities.

PRODUCTS OF *Firth Sterling* METALLURGY

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SINTERED TUNGSTEN CARBIDES • HEAVY METAL • CERMETS • CHROMIUM CARBIDES
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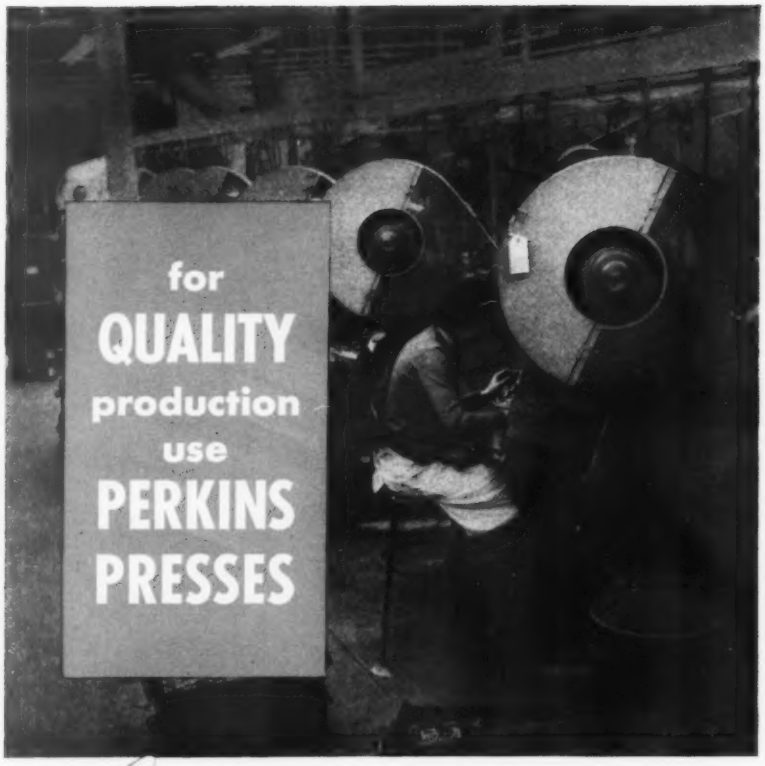
FIRTH STERLING TRADE MARK

CIRCLE INFORM-A-GRAM KEY NO. 23



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Greist are manufacturers of the world's finest sewing machine attachments • metal stamping and assembly specialists since 1871. Greist uses approximately 75 Perkins Presses from 10 to 60 tons capacity, many of them in production of a nationally famous camera.

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Look into the many features you get in Perkins Open Back Inclinable line — most popular type in use! 10 models, from 5 to 135 tons, mechanical or air safety clutches, bronze bearings, semi-steel frames, automatic release brakes, 1-man inclining, piston knockouts — to mention only a few.

Write Dept. TP-2 for complete Technical Information.

For expert on-the-spot press engineering assistance, call in a Perkins Field Engineer.

PERKINS
MACHINE COMPANY
WARREN, MASS., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 24

. . . Month's Talk from page 22

cause the process it performs is no longer the best way to do the job.

I have been talking here about the single replacement — about the one machine at one work station. I have been talking about the importance of making the decision right. But there's another problem, equally important — maybe more important. This is the problem of making sure the decision is made at all.

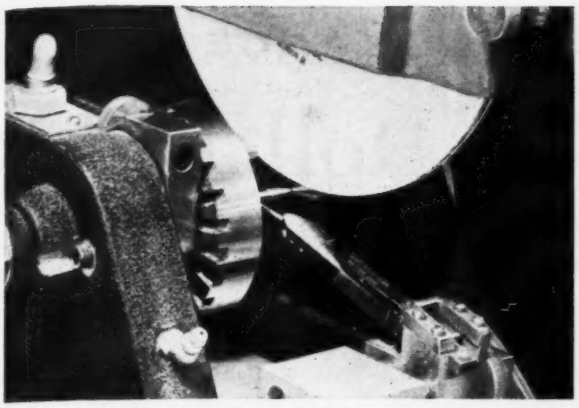
Quite generally, the plant manager looks into a replacement only when a builder's salesman or an operating supervisor shoves a replacement proposal under his nose. Once in a while he will approve one of these proposals. But how does he know that all the while there may not be other machines in the shop which cry for replacement even more than the one he approves? These are the ones which no salesman or supervisor happens to have drawn to his attention. For all he knows, these unknowns might be replaced with a far greater return on the investment than the ones he is approving.

Have a Replacement Policy

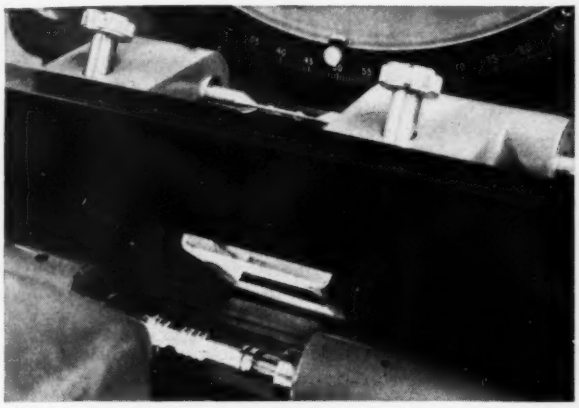
This brings us face to face with the question of equipment policy. The industrial executive is responsible through his board of directors to the stockholders of the company. His job is to place the funds of his stockholders for the most advantageous investments falling within the scope of the corporate charter, and to make those investments as profitable as he can. Now, if he puts half a million dollars into, let's say, product research and development, it may increase net profits after taxes by $75,000 for a return of 15%. He thinks he's done a good job. But, in the meantime, he might have put this same sum of money into a modernization program and gotten 20 to 30% out of it, and he would have done a much better job. As long as he places the company's funds into anything less than the most lucrative investment available, he is not carrying out to the fullest his responsibility as a corporate executive.

This seems like a whopping big order, doesn't it. What I seem to be saying is this: If this executive has 2,000 pieces of equipment under his jurisdiction, he should know at what return on investment each one of them might be replaced at the present time. To do this he should know what is the best new model currently available for each one of these machines. He should know

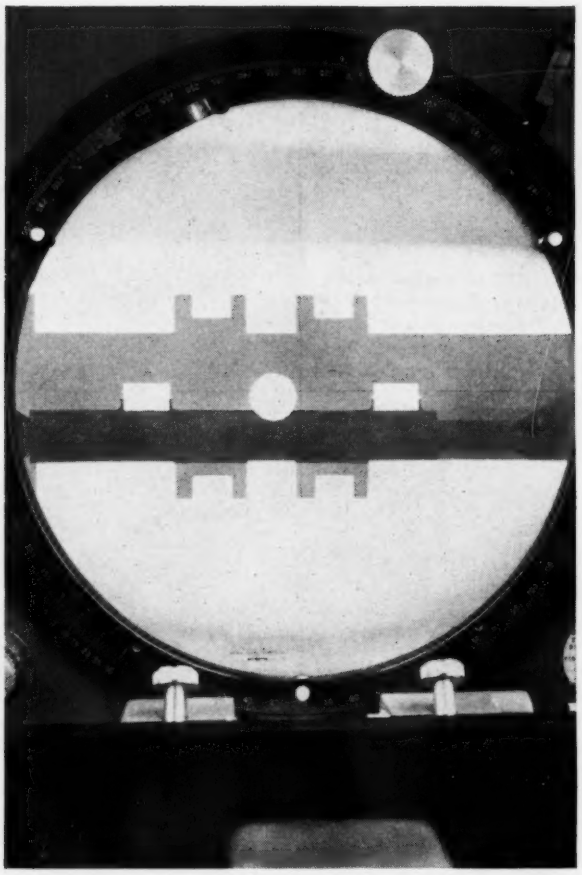
. . . Continued on page 27



1. Piston lands on hydraulic control valves are trimmed on a surface grinder fitted with motorized centers.



2. After trimming, piston and sleeve are mounted on worktable of Kodak Contour Projector for simultaneous projection by two light sources to gage amount of stock removal.



3. Overlap of piston and sleeve images is indicated by black area; overlap can be measured quickly by traverse of one part and observation of dial indicator.

How to do a 7½-hour gaging job in half an hour

How would you solve a gaging problem like this one?

In developing hydraulic control valves, engineers at a major firm producing aircraft components worked out a neat method of trimming piston lands in relation to ports in their mating sleeves.

But meeting the required .0002" overlap between piston lands and sleeve ports meant using several different gages to determine the amount of stock which had to be trimmed. Result: *7½ hours to trim each valve.*

To solve the problem, quality control engineers now use a Kodak Contour Projector with two light sources and two filters, one red and one green. This system projects a superimposed image of the piston on the sleeve. Where an overlap occurs, the red and green images combine into a black image. The width of this black overlap gives the amount of trim required. Result: *just ½ hour needed—7 hours saved on each valve!*

Maybe you've come up against a gaging problem that's eating up time and money in large quantities. To learn how you can solve it by optical gaging, send for the booklet "Kodak Contour Projectors." Write to:

Apparatus and Optical Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

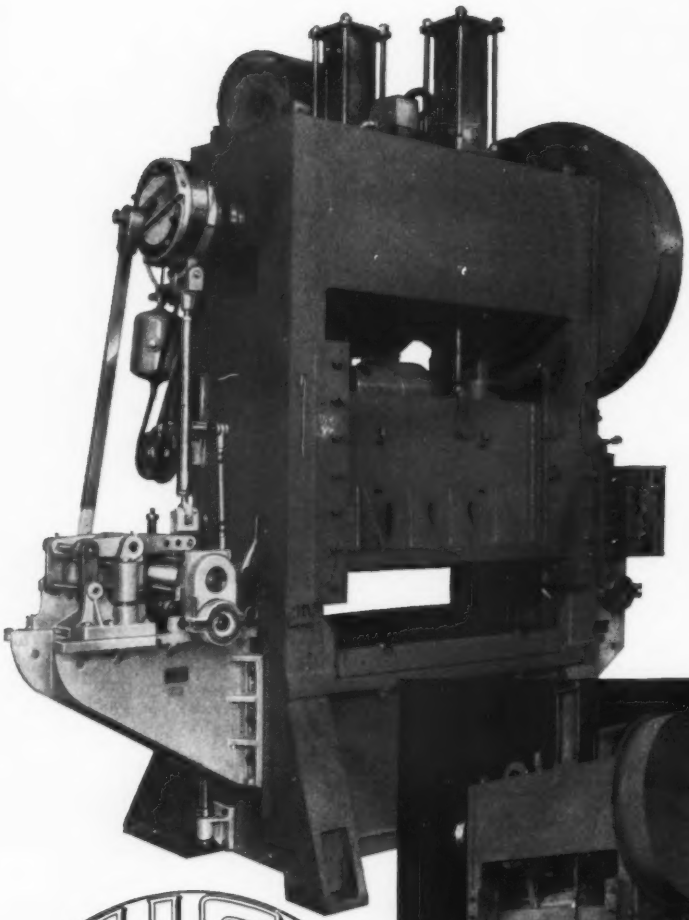
the KODAK CONTOUR PROJECTOR

Kodak

CIRCLE INFORM-A-GRAM KEY NO. 25

FOR CONSISTENT PERFORMANCE

U. S. Style "B" Roll Feeds

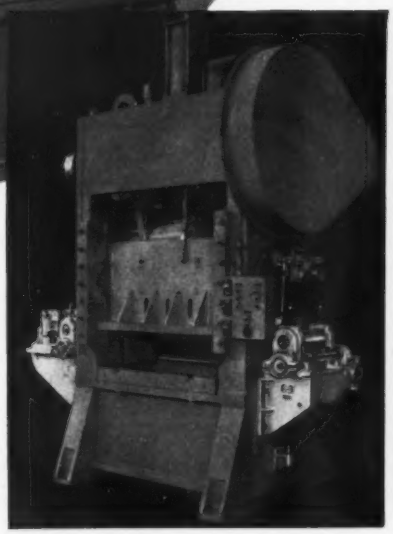


The introduction of U. S. Tool Company Style "B" Roll Feeds brings to your Press-Room a new line of Rack and Pinion Roll Feeds in a range of sizes to keep pace with most production requirements.

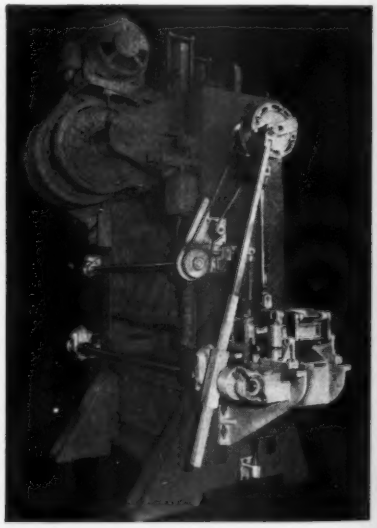
U. S. Style "B" Roll Feeds are made in both double and single types, with bolster plate for O.B.I. presses or with adjustable mounting brackets for straight side presses.

All Style "B" Roll Feeds are equipped with hardened and ground rolls of hollow construction, which are driven by hardened spiral gears running in oil. These gears are mounted in an enclosed housing. The roll-pin type over-running clutch has carbide inserts. Standard equipment also includes manual roll lifters; self-equalizing brakes; two-piece adjustable driving eccentric to simplify timing the feed in relation to the motion of the ram of the press; stock oiler and eccentric operated scrap chopper. Automatic roll lifters are available in either ram operated or adjustable eccentric operated types.

For full information regarding the U. S. Style "B" Roll Feeds write for your copy of Bulletin 85-P.



U. S. Style "B" double Roll Feed Model No. RF-1212, with scrap chopper mounted on a modern straight side press. This particular installation handles stock widths up to 12", with feed length adaptable up to 12".



Rear View: Showing the rack and pinion mechanism and cross members for actuating the entering feed and eccentric operated roll lifters. One of 5 models of U. S. Style "B" Roll Feeds will fit your Press Room Eqiupment.

US PRODUCTS

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Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Wire Straighteners
Die Sets
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U. S. TOOL COMPANY, INC.

AMPERE *(East Orange)* NEW JERSEY

CIRCLE INFORM-A-GRAM KEY NO. 26

. . . Month's Talk from page 24

what the effects of this new model would be on a wide variety of the areas of his operation, departmental cost, the materials which can be used, inspection and rework, employee safety, subsequent operations, product quality, and so on. For each of these machines he should know what alternative processes might be employed and should have tried them out.

I don't mean to ask the impossible. The job can be simplified. First of all, he can group the machines. For a battery of machines of the same model and doing the same work, a decision on one of them is a decision on all. Secondly, he can ignore all machines which have been installed fairly recently, setting for himself some benchmark such as two years, depending on the operation. He reads the trade journals and goes to conventions, and he can make note of certain operations where he knows that changes are going on fast and watch these especially closely.

He can cut down on the calculations by making a quick preliminary calculation on a promising replacement. Sometimes the savings on direct labor alone, right at the work station, will return 100% on the investment the first year. Why look further? As time passes, he will build a file of replacement investigations which have been made on particular machines and which have been set aside as not quite good enough. These should be watched closely. They can be brought up to date periodically with a minimum of work.

This work should be done on a systematic and all-inclusive routine. Once these classifications have been made, and once the schedules of analysis have been established, some one man should be made responsible for gathering the information and for drawing up a periodical report for presentation to the financial officers of the firm. This report should consist of a list of replacement opportunities in the plant, properly grouped and summarized as to respective rates of return and the degree of uncertainty and conjecture in the estimates.

The machine replacement opportunities will fall into the budgetary planning alongside product development, construction of new plant, building the dealer organization, and all the other possibilities which compete with each other for money. The financial officers will have a rational

. . . *Continued on page 28*

FGM

PLANNED STORAGE
. . . ASSURES MINIMUM SPACE AND HANDLING TIME

Steel catwalks on F-G-M long span Bulk Storage Racks utilize space up to the ceiling.

F-G-M Pallet Frames permit stacking on pallets of loose, irregular or crushable loads with full access to materials stored at all times.

Dimensions, weights, physical properties, volume and turnover of material into and out of your plant form a highly individual distribution pattern. To assure maximum efficiency in handling and storage, investigate F-G-M Planned Storage.

Time-proved F-G-M systems require minimum floor space, minimum manpower, cut factory costs. An F-G-M survey is yours for the asking.

Send today for your free copy of Bulletin No. 700-A on how to double your storage capacity. The Frick-Gallagher Mfg. Co., 106 S. Michigan Ave., Wellston, Ohio.

FGM

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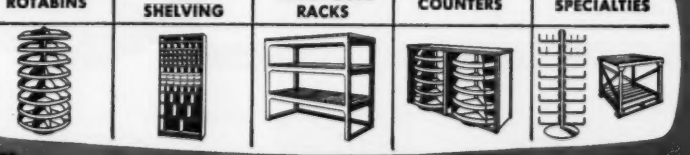
BONDERIZED
STEEL EQUIPMENT FOR EVERY STORAGE NEED

ROTABINS | STEEL SHELVING | WAREHOUSE RACKS | COUNTERS | SPECIALTIES



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CIRCLE INFORM-A-GRAM KEY NO. 27

. . . Month's Talk from page 27

basis for comparing the modernization program with other projects and when they approve certain machine replacements and reject others they will know that they are not putting money into the less promising investments at the expense of the more promising.

Not Always Perfect

Admittedly, there will be many errors. When you handle machines in groups as to age, for example, an occasional one which you leave out of account because it is too young may actually call for replacement. You won't know it. When you figure the effect on product quality or on direct labor cost, you have to forecast what the proposed new model will do, and you find yourself in the area of conjecture. So you make estimates which are half guesses. Some of them will be wrong. But, there is no human way to avoid error entirely.

What we are talking about here is not perfection, but the best job humanly possible. We are talking about policy. A good policy is not one which seeks to eliminate all error; it is one which minimizes error. Such a policy will be rational, and the executive who makes decisions on it will know exactly why he made them.

So much of American industry is out of date because corporate executives have not yet brought the full power of financial thinking into the production department. When the machine builder's representative comes around, he is sometimes treated as a peddler, as an intruder. I have heard salesmen tell of deliberate efforts to embarrass them and to make it as hard as possible for them to deliver their message. But, if the salesman is any good, he is not an intruder nor a peddler. He has dollars for sale. He is an investment salesman. The executive who throws blocks in the way of the machine builder's salesman is actually defying the man to show him a way to make more money. Such an executive, in his capacity as custodian of the stockholders' funds, is backing away from his basic responsibility as a businessman.

But, we are moving from the era of the tough buyer. Under the more rational calculation of replacement questions sparked by the MAPI studies we may well be on the threshold of a revolution in replacement policy. Admittedly, it has not yet gone very far. But various trade associations — notably the National Machine Tool Builders Association — have carried the movement forward. A large and growing number of machine builders have come to realize that rational calculation will sell more new machines than inspirational drum beating. Leading metalworking firms in a wide variety of industries are adopting a continuing and well-conceived replacement policy.

Years ago we saw changes of this kind get under way in other fields — rather long ago in inventory control and a little later in standard costing, to name just two. Alongside these highly developed scientific fields, equipment policy has remained in the realm of impulse and intuition. On the start which has been made there is every reason to hope that rationality will become the rule in this field, too, rather than the exception, to the tremendous betterment of productivity in all our industries.

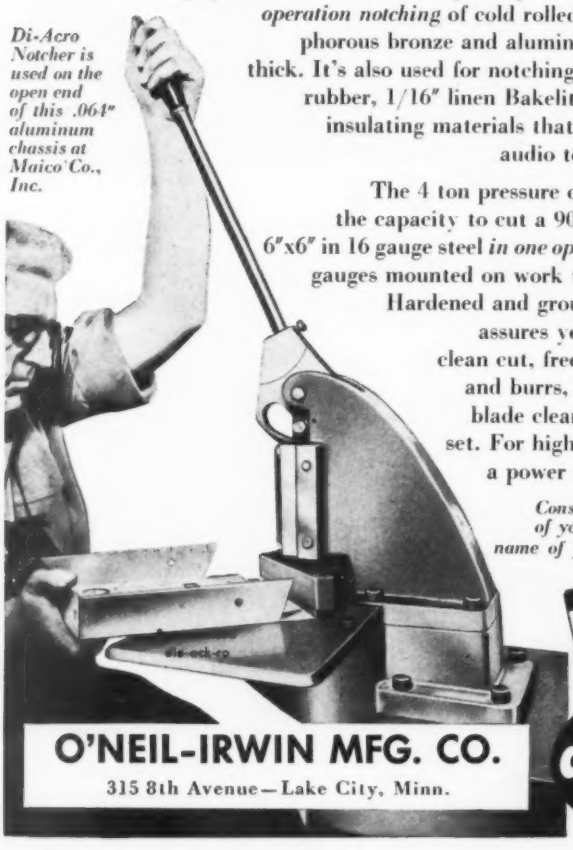
DI-ACRO*NOTCHER Speeds Production, Saves Extra Operations on Chassis Work

"I use our Di-Acro Notcher for practically everything," says V. Johnson of Maico Co., Inc., Minneapolis manufacturer of hearing testing equipment. "This machine speeds production—*provides one operation notching* of cold rolled steel, brass, phosphorous bronze and aluminum up to 16 gauge thick. It's also used for notching fish paper, sponge rubber, 1/16" linen Bakelite and other circuit insulating materials that go into chassis for audio testing equipment."

Di-Acro Notcher is used on the open end of this .064" aluminum chassis at Maico Co., Inc.

The 4 ton pressure of this machine has the capacity to cut a 90° notch as large as 6"x6" in 16 gauge steel *in one operation*. Adjustable gauges mounted on work table are standard. Hardened and ground triangular ram assures years of precision. A clean cut, free from rough edges and burrs, is possible because blade clearance can be easily set. For high speed production, a power model is available.

Consult the Yellow Pages of your phone book for the name of your nearest Di-Acro distributor or write us for catalog describing this and other Di-Acro machines



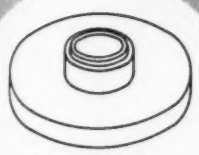
O'NEIL-IRWIN MFG. CO.
315 8th Avenue—Lake City, Minn.

di-acro PRECISION METALWORKING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 28

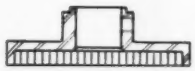
Bodine

CASE HISTORY NO. 48...



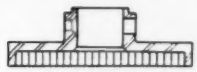
Hand load blank to fixture-type dial. Auto inspect and clamp.

1



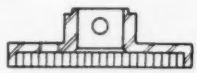
Drill .173" dia. one side. Horizontal drill spindle.

2



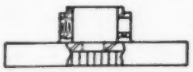
Drill .116" dia. 2nd side and chamfer. Combination tool. Horizontal drill spindle.

3



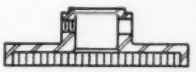
Drill .187" dia. hole through. Vertical drill spindle.

4



Tap #6-40 CL 3 hole to size. Horizontal tap spindle. ALSO drill .187" dia. hole. Vertical drill spindle.

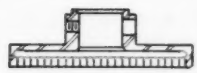
5



Countersink .430" dia. with Welden 90° c/sink. Vertical drill spindle.

Auto inspect for broken drills or taps.

6

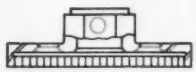


Undercut teeth using special recessing tool. Inverted drill spindle. (Hold down vertically.)

7

Gang mill .062" slot and flat. Vertical milling spindle.

8

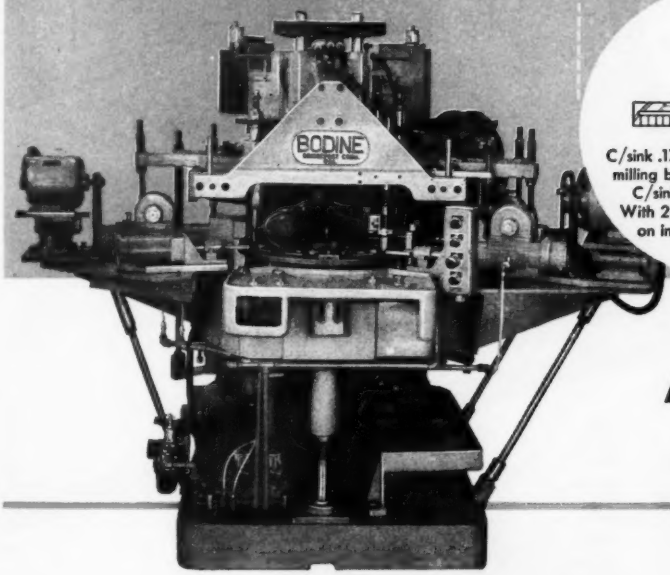


C/sink .173" dia. hole to remove milling burr. Horiz. drill spindle. C/sink 2 .187" dia. holes. With 2-spindle multiple-head on inverted drill spindle.

9

Ream .430" dia. to remove burr. Vertical drill spindle.

10



All this and better QUALITY CONTROL too!

PART and MATERIAL: Clutch drum, steel B1117

PRODUCTION: 4200 operations (300 pieces completed) per 50 min. hour.

The remarkable versatility of Bodine Basic Machines and tooling methods is well illustrated by this recently completed unit for Teletype Corporation. Production, however, is only part of the story. Superior *quality control* was the main reason for development of this new production method for Teletype.

The part is a steel clutch drum on which no less than *14 operations* are performed, with two automatic inspections built into the cycle.

There are 4 vertical drill spindles and 1 vertical milling spindle; 3 horizontal drill spindles and 1 horizontal tap spindle; 2 inverted drill spindles. Parts are hand-loaded but automatically ejected. The station is washed after ejection.

Just think what it means in the production of a part like this when one compact machine and one easily maintained set of tooling can handle *4200 operations* per hour to close limits, plus control inspections. Yet this is only one of many outstanding examples of Bodine practical aid to cost or quality-troubled manufacturers. Send us your next tough job . . . parts or prints . . . for production analysis. Write Dept. TP-7.

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING MILLING, TAPPING, AND SCREW INSERTING MACHINES

2BD98

CIRCLE INFORM-A-GRAM KEY NO. 29

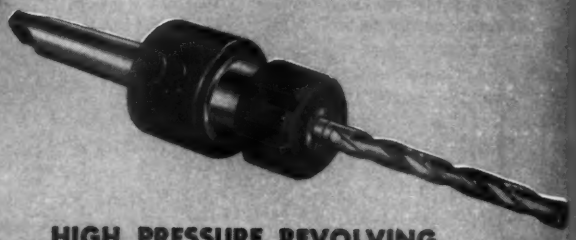
UNIVERSAL BORING CHUCK is heavy and rigid for all types of rough boring without chatter yet accuracy of adjustment adapts it equally well to finish boring. Time-tested Universal Collet nose holds boring tool much more rigidly and securely than set screws while precision and extreme accuracy of feed-adjustment are obtained by an anti-backlash arrangement of feed screw and large dial.

UNIVERSAL
COLLET CHUCKS

combine maximum holding power and minimum run out with simplicity of design and low price

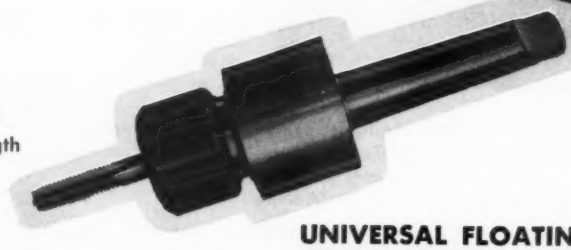
The basic collet principle is the same in all Universal chucks. Tools gripped in these chucks withstand a maximum thrust and radial load because the collet grips on a continuous surface its full length and positively locks the tool. Write today for new catalog showing the complete line of Universal collets and chucks.

UNIVERSAL RELEASING TAP CHUCK has same basic collet principle featured in all Universal Collet Chucks. Screws or sleeves are not needed and collets are interchangeable with other Universal chucks. Simple, compact design has no springs, cams or pawls to break or wear. Can be used for either right or left hand tapping without adjustment.



HIGH PRESSURE REVOLVING COOLANT TRANSFER CHUCK has standard Universal Collet Chuck nose and a variety of shank sizes can be held by simply changing collets. Minimum overhang is made possible by the single face seal design. Back pressure principle of this design prevents "brake" action thus lowering torque on spindles. Chucks for higher speed and pressures than standard plus a variety of mountings are also available.

210

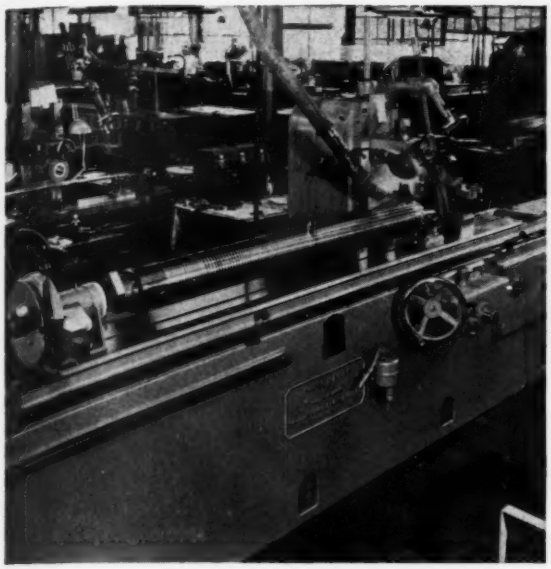


UNIVERSAL FLOATING COLLET CHUCK for horizontal or vertical operation is positively protected against destructive action of coolant by a seal which prevents entrance of compounds into interior of assembly. Frictionless ball bearing flat springs are adjustable to counter-balance weight of the tool.

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 30

IF YOU GRIND BROACHES AND SPLINES...

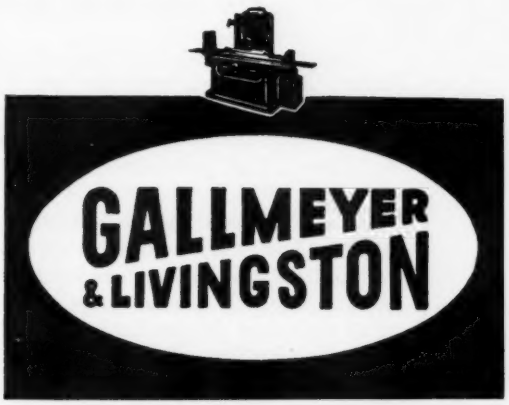


Battery of Grand Rapids Broach and Spline Grinders at Apex Broach Co., Detroit, Mich.

. . . take a cue from many of the nation's best known producers who use the only machine specifically built for broach and spline grinding. It's the Grand Rapids Broach and Spline Grinder, the only one of its kind — and the machine that offers so many features for faster, easier, big volume, high quality grinding that you'll soon see why it's preferred over machines merely adapted for broach and spline grinding.

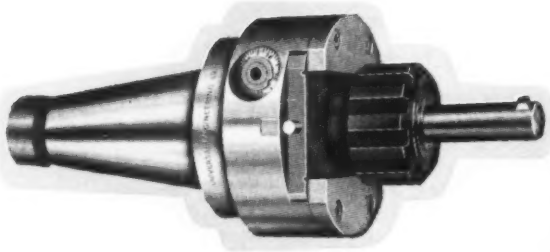
Working surface of its table is 7" wide x 72", 90" or 120" long. Table speed is infinitely variable up to 70 fpm. Column is rugged one-piece casting. Vickers hydraulic pump with our own control valve. Separate hydraulic system for easy maintenance. Sealed-for-life spindle. And, of course, it's available engineered to your individual requirements.

May we tell you more? A note on your letterhead will bring full details.



GALLMEYER & LIVINGSTON CO.
495 Straight Ave., N.W. Grand Rapids, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 31



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combine maximum holding power and minimum run out with simplicity of design and low price

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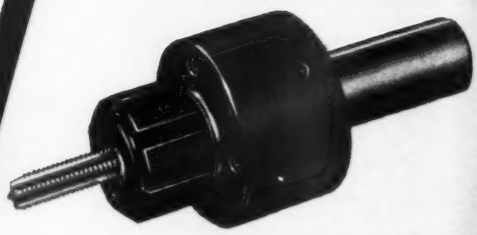

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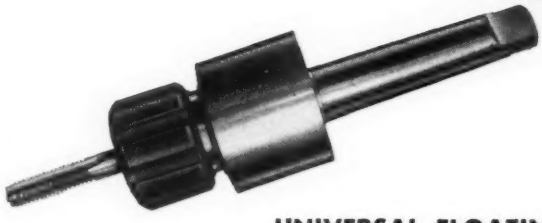

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UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 30

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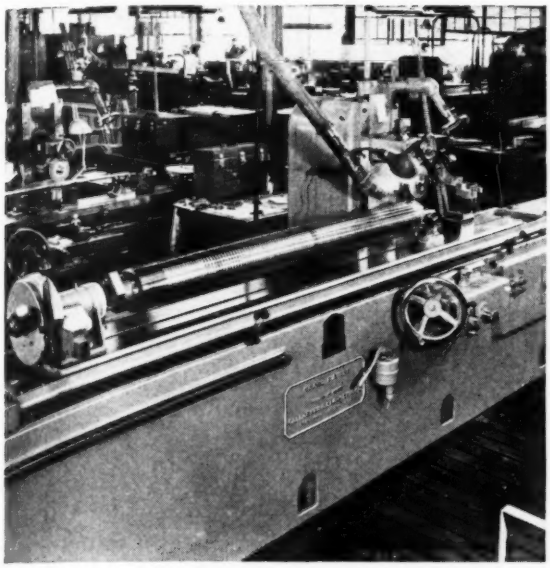

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Working surface of its table is 7" wide x 72", 90" or 120" long. Table speed is infinitely variable up to 70 fpm. Column is rugged one-piece casting. Vickers hydraulic pump with our own control valve. Separate hydraulic system for easy maintenance. Sealed-for-life spindle. And, of course, it's available engineered to your individual requirements.

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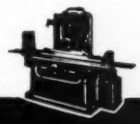


GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON CO.
495 Straight Ave., N.W. Grand Rapids, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 31

ERICKSON

QUICK CHANGE HOLDERS

...for use with your standard MMS tapered tools ...designed for presetting of tools

Now you can use your present standard MMS tapered tools with the *new* Erickson Quick Change Holders. That means you get the double production advantage of Erickson's *high precision coupled with the rapid change feature.*

Several different models comprise the line: Morse taper holders for boring mills and radial drills, milling machine holders that fit standard spindle tapers, turret lathe holders that increase turret lathe tool-holding capacity, straight shank holders with #30 or #40 MMS socket. These holders take Erickson Collet Chuck milling machine adapters in both regular and heavy duty types, end mill adapters, shell and face mill adapters, Morse taper adapters, boring head adapters, and chuck adapters for Jacobs internal taper.

AA-7455

A call or card will bring the Erickson representative on the double. Meantime write for your copy of Catalog G "Erickson Quick Change Holders."

ERICKSON TOOL COMPANY

34351-7 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

CIRCLE INFORM-A-GRAM KEY NO. 32

RECESSION: ACTION vs TALK

EVERYONE, INCLUDING YOU AND YOU AND YOU, is talking about the recession.

Some, admittedly, are being hit harder than others. And, human nature being what it is, those who are hit the hardest are doing the most talking.

Others, a distinguished and, we hope, growing group, are finding that action, rather than conversation can be a pretty powerful recession antidote.

To get this theme out of the realm of the Pollyannas and into an orbit of practicalities, let's take the case of Lyon Metal Products, Inc., of Aurora, Illinois.

Early in March the company's sales division came up with a decision which, at the risk of over-simplification, had the sure fire and foolproof ingredients for licking their own unwelcome share of the recession. They declared, then and there, that they were going to sell enough volume—not to put their competitors out of business—not to ring up fabulous profits and dividends—but simply sell enough volume to return laid-off workers to their jobs!

Now there's an anti-recession program of the first water—sell enough to return laid-off workers to their jobs! It's the essence of simplicity plus powerful human motivation. Although it savors of single purposeness, is there any other single purpose that, attained, would so completely relegate this recession to past history?

If Lyon's philosophy and action could be implemented and multiplied on a nation-wide scale the only reference to the recession would become the question "What Recession?"

Proof of the pudding lies, of course, in the fact that for Lyon it is working, here and now. Can't we resurrect a time-worn phrase and say that what is good for Lyon is good for the country? As this is written, a scant month and a half after initiation of the drive, 145 of 222 workers have been called back to work and are now on the job.

So comes the inevitable question: if Lyon can do it, why can't you? If we can just free our minds of the economic road blocks which are so easy to fall back on in order to justify our hand-warming posture, and realize that, after all, the name Lyon simple means people, we have made a start. Who in this country is willing to stand up in meeting and say that he can't do what other people are doing?

The success and accomplishments of the Lyon plan are not due to mere wishful thinking. The sales division has been aided and abetted by top management.

As a first step, Vice President Olesen called all district sales managers to Aurora. Every manager was given a job to do: sell more Lyon products and get "all lay-offs" back on the payroll.

Managers were asked to have every salesman make an extra call per day. The salesmen were given new products, new advertising, sales promotion and sales programs to help them sell more products. The men were told: "Every extra $2900 you sell, returns a Lyon worker to the starting bell!"

To get impetus from new products, a new catalog was rushed. Twelve pages of new products were added to a 72-page catalog. Although they could have "coasted" another six months on the supply of old catalogs, 200,000 copies of the new 84-pager were put in circulation — put out to work, not out to pasture!

The sales division was further back-stopped with equipment, dies, production detailing and additional advertising all under way and pointing to a major new line to be announced in August.

Lyon's 1957 annual report disclosed a capital expenditure of $510,000. Last April the Lyon board of directors got in the act and approved $700,000 in contracts for equipment and plant expansion (part of a million $ expansion earmarked for 1958).

Other forward looking moves include: finalized plans for further office automation; promotions from the ranks of their young executive trainees; and election of two new outside directors to replace inside directors — to secure more outside viewpoint; to name but a few.

The whole Lyon program is more comprehensive and detailed than this page can convey. If you'd like a play-by-play account, a request to the writer will get you their anti-recession formula.

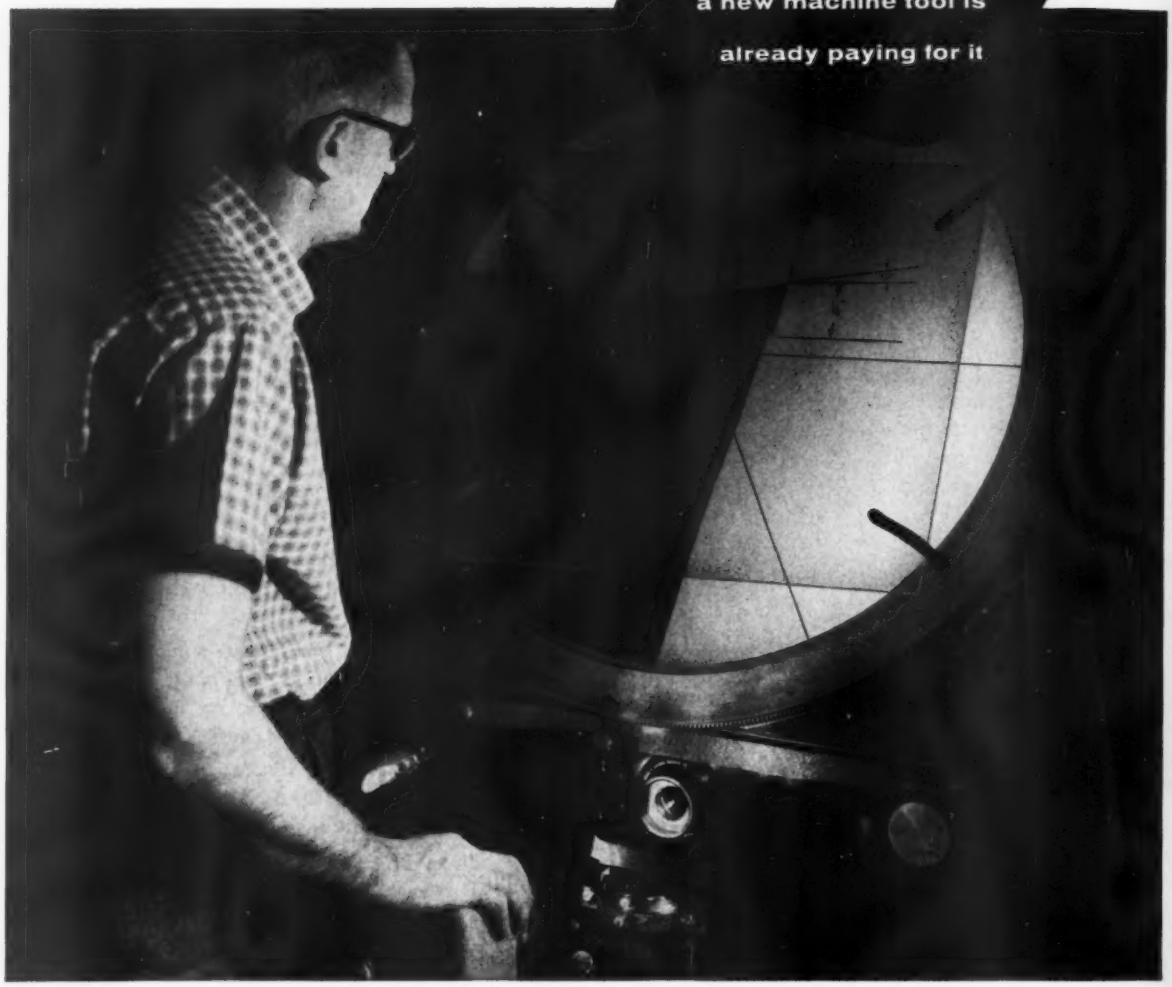
From where we sit, it looks as though our friends in Aurora are going to get a Lyon's share of the business!

E. Willard Pennington

editor

JONES & LAMSON OPTICAL COMPARATORS

the man who needs
a new machine tool is
already paying for it



Tool inspection is easy — same with "hot" stuff

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MAINTENANCE TRAINING FOR NUMERICAL CONTROL EQUIPMENT

by Charles E. Johnson
Electronics Training Supervisor
BOEING AIRPLANE COMPANY
Seattle, Washington

"Maintenance will present the biggest problem to the new owner of a numerical control outfit." These words from the T&P special feature on numerical control (December, 1957, p. 89) previewed this concise report. Included are the evaluation, development, and content of a program that we believe will prove a definite help for your own advance planning.

MAINTENANCE TRAINING FOR NUMERICAL CONTROL EQUIPMENT is a subject being discussed by many companies that are planning for numerical control.

The introduction of this equipment has brought with it new concepts of machine control foreign to the majority of maintenance personnel. Its complexity surpasses that of any equipment that they have been called upon to service, and the problem is compounded by the mixture of electronics and machine tool science. A review of the electronics, mechanics, and hydraulics involved indicates that specific knowledge of all or combinations of them will be required to isolate malfunctions efficiently. Because of the large investment in the equipment, downtime must be held to a minimum, and maintenance personnel must be able to remedy any malfunction rapidly. This requires ability to diagnose, which is based on an understanding of the equipment.

In order to obtain the maximum capability of numerical control, a training program must be evolved which will produce personnel able to perform efficient trouble-shooting, adjustment, and repair operations. Before planning this program, it is necessary to evaluate the present knowledge of the men available and the knowledge that they will require.

Evaluation of Requirements

In comparing numerically controlled equipment with the present equipment, it is found that the major difference exists in electronics. The *mechanical* aspects of the computers, tape preparation units, and the machines themselves are similar or identical to equipment now in use, but the use of precise positional feedback from the machine motion will be a major mechanical difference.

Adapted from a paper delivered at the recent AIEE Machine Tool Conference at Milwaukee, Wisconsin.

On the *electronic* side, we see a new world unfolding. Computers principally designed for numerical control, "black boxes" to convert our present computers, interpolators to convert computer data into machine command information, and machine control systems to transform the machine commands into a precision workpiece represent only part of the electronics evolution.

In order for the machine to produce a precision workpiece, the electronics must not only command the machine but compensate for certain inherent characteristics, such as inertia, friction, and backlash. These cannot be completely neutralized, but considerable compensation can be employed. They must be adjusted and checked with the machine in motion, because, in a closed loop device with dynamic compensation, the effective signal is a composite of the command signal and the rate feedback signal from the output motion, plus components of these signals differentiated and integrated with respect to time. To maintain a machine of this nature properly, a working knowledge of electronics, mechanics, and closed loop servomechanisms is required.

Knowing the operation of one link in the equipment is not sufficient. When a workpiece being produced is found to be in error, the cause may be located in any of the many links from the drawing through machining. Since the error is detected on the workpiece, machine maintenance personnel will be called upon to correct the trouble. The first step will be to determine if the machine is at fault or if the error is in the control information. This will require a thorough knowledge of both machine and the machine control system.

In evaluating our training requirements we also should remember that as time goes on, industry's demands of such equipment will increase. Closer tolerances will be required which will mean new control systems and new machines operating at peak performance.

Development of a Training Program

After examining the complexity of the equipment and the limitations of our maintenance people, we can determine, to a degree, the training required. For efficiency, the maintenance personnel should be divided into two distinct groups.

The first group should be primarily engaged in the *mechanical field* with a limited knowledge of control circuitry. The second should be primarily engaged in the *electrical/electronics field* with a considerable knowledge of machine tool operation.

As the electronics involved differ considerably from those in manual equipment, the acquisition of personnel for the second group will be more difficult. The rapid growth of electronics has absorbed the majority of capable men, leaving few available who are acceptable without training. This training within the company will increase the overall morale and efficiency of those employees whose stability has been determined. Therefore, for the major complement of the electronics maintenance force, it will be advantageous to train presently employed, well-screened maintenance personnel in electronics and supplement this group with electronic specialists. Those selected for training should be evaluated for their background knowledge, for their ability to adapt themselves to more complex equipment, and for their interest in learning new technology.

The background requirements for the personnel involved with *mechanical* maintenance will generally be met if they have served apprenticeships, have had a diversified mechanical career, and have had experience on the machines being adapted to numerical control. In selecting personnel for the *electrical/electronics* crew the emphasis on experience is not valid because it should be assumed that experience on this portion of the equipment is not available. Therefore, prior to indoctrination on the equipment itself, extensive training will be required to provide abstract electronic knowledge. It is important that the people selected have as comprehensive a background in electrical and mechanical equipment as possible. It is more important, however, that these people have the ability to learn for without this the complete training program cannot produce effective results.

Contents of a Training Program

A. Training for the *mechanical* crews should include detailed coverage of the following:

1. Factual knowledge of the equipment, i.e., its capabilities, limitations, and expected performance.
2. Explanation and demonstration of alignment and adjustment of the equipment.
3. Layman coverage of the electronic controls with emphasis on *how* the system works, *not why*. Coverages of control and interlock circuitry to enable them to operate the equipment unaided.
4. Study of preventive maintenance procedures.
5. Study of equipment drawings and procedures of maintenance peculiar to this equipment.

6. Explanation of problem areas peculiar to this equipment.

B. It will be advantageous to break the training for *electronics* into three phases: Basic Electronics, Systems, and On-the-Job.

1. The Basic Electronics training is given to personnel with insufficient electronic knowledge to absorb Systems training efficiently. This is provided the man possesses suitable aptitude for learning electronics with the purpose of increasing his basic electronic knowledge to a degree where he can rapidly comprehend and analyze electronic circuits. The minimum amount of time required to accomplish this is approximately 600 hrs. The contents of this course may be broken down into nine phases:

a. 80 hrs of *math review* to refresh high school algebra and trigonometry, which will provide understanding of elementary vector algebra required later in the course. This 80 hrs serves several functions: It reviews the minimum math required for an electronics technician; it serves to accustom the student to study and logical thinking; and, because of the high correlation between the ability to learn mathematics and the ability to learn electronics, the first 80 hrs serves as a proving ground of the student's overall learning ability.

b. 80 hrs of *direct current fundamentals.*

c. 120 hrs of *alternating current fundamentals.* This section is often misunderstood.

d. 40 hrs of *soldering and wiring* training. A high degree of skill is required for proper repair, with the new developments in electronic construction such as printed and etched circuits, special plugs and connectors, and miniaturization of component packages.

e. 80 hrs of *vacuum tubes, amplifiers,* and *oscillators.*

f. 40 hrs of *radio circuits.* This serves to further embed the fundamentals of vacuum tubes and is preparatory to the section that follows.

g. 40 hrs of *special vacuum tube circuits,* covering the types of circuits found in computers and other numerical control equipment.

h. 40 hrs of *transistor fundamentals,* giving the student an insight into this new device.

i. 80 hrs of *elementary servo principles,* designed to convey the general principles of feedback control systems, with special emphasis on the dynamic aspects of controlled motions.

Of the 600 hrs covered, 200 hrs should be devoted to laboratory exercises, enabling the student to learn the proper use of test equipment and to obtain more than a theoretical knowledge. The area used for lectures should contain individual lab facilities for each student, with oscilloscopes, meters, signal generators, and the circuits and components which each experiment features.

2. The Systems Training constitutes training on a specific group of integrated components. The objective is to give the maintenance personnel a complete understanding of the equipment. Training should include:

a. Explanation of capabilities, performance, and limitations of the equipment.

b. Complete theory of operation giving the student comprehensive knowledge of all circuits and components enabling him to diagnose and repair, without technical aid from other personnel, any electrical or electronic malfunction.

c. Detailed explanation on the functioning of the mechanical components, with emphasis on how and why they work, not how to repair them.

d. Simulated possible malfunctions for class exercise, enabling the student to exercise his knowledge and develop trouble-shooting techniques.

e. Demonstration equipment (simulating the actual equipment) for purposes of trouble-shooting and adjustment.

3. On-the-Job training should follow Systems training to tie in the classroom with the equipment. Here the student practices the theory learned in the classroom and familiarizes himself with the equipment and components. On completion of this final phase, the personnel should be capable of reliable maintenance of numerical control equipment.

The Basis for Adoption of a Training Program

This outlined approach has been utilized by the Boeing Airplane Company with excellent results to train electronics technicians working on aircraft, missiles, and in development laboratories over the past four years. It has the flexibility to adapt itself to varying degrees of complexity in the equipment and to variations in personnel available to maintain the equipment.

Versatility of the man is a result of the thorough background preparation, permitting him to be shifted to a new machine with only brief systems and on-the-job training. It equips him with the technical skill required through essential basic knowledge, specific systems knowledge, and application of this knowledge by way of on-the-job training.

end

The Inform-A-Gram card which follows page 114 is for your convenience in making inquiries about advertised Products and Editorial items.

**Whether You Design, Build,
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THE BEHAVIOR OF SLIDING BEARINGS

by R. A. Langdon
Tool Engineer
GISHOLT MACHINE COMPANY
Madison, Wisconsin

It is important that machine tool buyers and users be acquainted with the factors that govern the selection of such design details as machine ways and gibs. The type of machine, its function, and the conditions peculiar to its application all influence the choice of construction, bearing material, and finishing process. Needed perhaps, by the machine builders, is a constant feedback of *your* experience with these design variations. — *Editors*

EVERY MACHINE TOOL MANUFACTURER has a responsibility to his customers to build the best quality possible into his tools at the least expense in regard to both initial cost and subsequent replacements. Since sliding surfaces play an important role in most machine tools, a better knowledge of the materials available, the slide mechanics, and the finishes available is essential. This article points out some of the theories relating to sliding resistance and research work that has been done, and indicates some possible future work that should be done to improve sliding bearings.

Theories of Resistance

A study of sliding bearings must be preceded by a knowledge of the two major theories of the resistance of the two materials to sliding: the welding hypothesis, and the new theory of metal transfer by I. Ming Feng[1].

It is commonly known that microscopic examination of any machined surface reveals small peaks (called asperities) and valleys, which vary in size and number depending on the material and the surface finish. When two materials are placed one upon another, they will touch only at these asperities; as a result, surface contact is established at extremely small areas. Figure 1 offers a schematic comparison of a coarse and a fine (low micro-inch rms) finish, and demonstrates the relative number of peak-to-peak contacts before a load is placed on the bearing surfaces. As the load on the bearing surfaces is increased, the asperities crush down plastically until the area of contact is sufficient to support the load.

Plastic deformation occurs because each grain of metal is made up of a number of atoms which may slip on each other at their boundaries. Also, the grains can slip in their slip planes over each other. By force it is possible to cause these grains to distort and to slip over one another to new permanent positions without rupture occurring in the metal. It is assumed that strong welds are created at these points. If the metals are alike, we assume that the strength of the weld

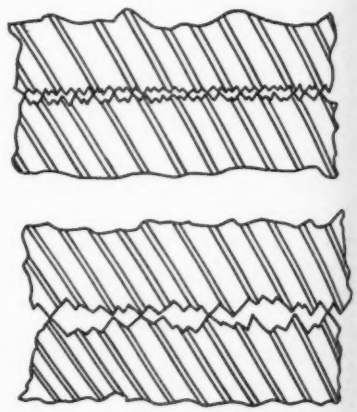

Fig. 1. This schematic comparison of a rough and a fine finish demonstrates the relative number of peak-to-peak contacts before a load is placed on the bearing surfaces. Under load, the asperities crush down plastically until the area of contact is sufficient to support the load.

is equal to that of the metal in bulk. If they are different metals, the welds will be weaker; but we assume that their strength is nearly as great as that of the softer metal. To start sliding, these welds must be broken.

The new theory of transfer and wear by I. Ming Feng answers one problem that is not answered by the welding hypothesis, and that is: what causes the small unwelded particles that are sometimes found when two metals are slid one upon the other? According to the new theory, when two contacting metallic high spots deform together plastically the abrupt movement along crystallographic planes causes roughening of the interface of contact. A slip plane with a slip direction lying in that plane forms a slip system. It is generally the case that several systems are operating during plastic deformation, and as a result the roughening will take place in several different directions. When a pair of firmly interlocked high spots is forced to move apart, breakage will occur at some distance away from the original interface and where the section is the weakest.

Most of the energy released during the process of breaking the high spots is finally transformed into heat which causes a sudden temperature flash. When the heat of the temperature flash is conducted through the interface, momentary diffusion occurs rapidly. If the diffusion process is rapid enough to cause welding of the sheared-off peak to the opposite high spot, a piece of transferred metal is formed. If the conditions are such that no appreciable diffusion can occur, the adhesive force, if sufficiently strong, can still keep the metal particle on the opposite high spot. The small piece of metal sheared from the high spot will leave as a loose wear particle when both diffusion and adhesion are feeble.

Elements Affecting Friction

There are a number of elements affecting sliding friction which must be considered in a study of this topic. These are:

1. Material combinations
2. Surface finish
3. Surface contamination
4. Lubricants
5. Hardness of mating materials

Material Combinations

The two materials which will be in contact with one another are, of course, prime factors affecting sliding friction. At first glance it might appear that only those materials which possess low coefficients of friction should be used in slide construction. However, since strength and rigidity and dimensional stability of the materials involved are also essential factors, certain bearing materials possessing a low coefficient of friction must be ruled out in favor of other stronger ones with higher coefficients. As in many other fields, the problem is not as simple as it might first appear.

Fig. 2. These cast iron vee-ways are from a large planer that has phenolic laminate wear strips on the mating surfaces. The scraped pattern on the ways shows no wear although the machine has been in constant heavy use for over two years.

Hardened steel riding on cast iron is perhaps the most commonly used combination for machine tool slides. Bronze wear strips are also used with very good success. Phenolic laminates in contact with scraped iron have been used successfully in some installations.

An advantage of phenolic laminates is that wear of the mating surfaces is negligible. The ways of large planers, Figure 2, and boring mills fitted with these laminates show no appreciable wear after several years' use. Phenolic laminates do have a low compressive strength when compared with steel, bronze, or cast iron. It might be expected that under normal circumstances, slides installed with these materials would loosen under heavy load. Fortunately, however, there is no evidence which would prove that this is true. Phenolic laminates do present a very definite disadvantage in that they absorb moisture readily. If very thick sections are used, this could become a problem, but this can be overcome by attaching thin sheets to a steel or iron backing, Figure 3.

Teflon, a fairly new plastic, has a low coefficient of friction when mated with cast iron. One of its disadvantages is its low thermal conductivity; it could overheat under high loads. Some recent tests of this material indicated that, due to its low yield strength, it conforms very closely to its mating surface and entraps the lubricant, with the result that the static friction is lower after the surfaces have been at rest for some time, than it is with some materials having higher strength. Possibly the new teflon tapes will prove to be satisfactory in lightly loaded applications where the lowest coefficient of friction is required and quick response is a requisite.

Another relatively little explored bearing material for sliding surfaces is chrome plating; it seems quite promising. The static coefficient of friction for steel on chromium-plated steel is 0.17, and the sliding coefficient is 0.16. The static coefficient of friction for steel on babitt is 0.25, and the sliding coefficient is 0.20.

In addition, chrome plating will produce a surface which will resist attack by almost all organic and inorganic compounds except muriatic and sulphuric acids. This quality will prevent etching of the wear surfaces, which can become a problem with unprotected iron or steel. The

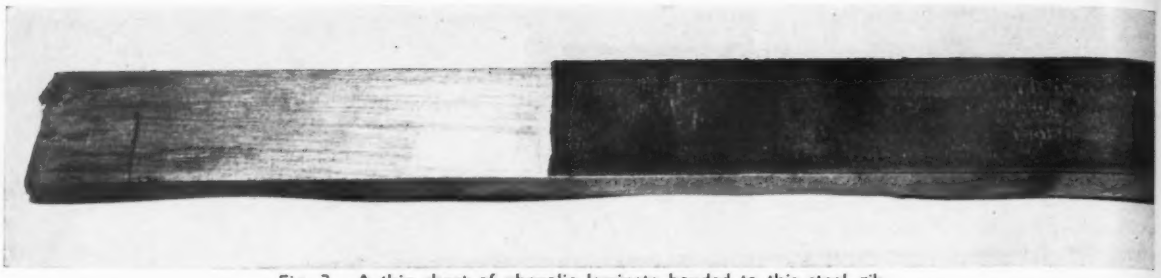

Fig. 3. A thin sheet of phenolic laminate bonded to this steel gib, lessens wear on the mating surfaces while minimizing the possibility of problems attributable to the plastic's tendency to absorb moisture.

fact that chromium plate is considerably harder than case-hardened plate is another advantage in its use, since the wear surface cannot be as easily damaged.

Surface Finish

The effect of surface finish on friction, metal transfer, and wear has been a controversial subject. It is not a simple factor to discuss because it influences not only the size and distribution of the areas of actual contact but the surface roughness of the high spots as well. Finch of the Imperial College of Science and Technology, London[2], discovered that the wear is greater when relative motion between mating surfaces is parallel to the lay of the surface finish, which seems quite surprising.

One of the most common surface finishes used in machine slides is the scraped finish. Scraping can produce a very irregular pattern with minute pockets in the surface which are valuable for trapping oil. If properly done, scraping provides an excellent control over the distribution of contact which is all-important in a good sliding bearing.

Another type of surface finish can be produced by grinding. The grinding process produces a surface with a very definite pattern or lay. Special grinding procedures are required for breaking up this pattern, in order to avoid excessive wear. The machine builder is also faced with the necessity of guarding against poor grinding practice which would burn, tear, splinter, or otherwise damage the surface. The process is comparatively cheap and the equipment is easily available, but further processing is usually required.

Figure 4 is a photomicrograph of a part heat-treated to 53-55 Rockwell "C", showing a ground surface of 15-20 micro-inches rms, chrome-plated to preserve the profile, and then sectioned on a taper. The oxide film, rehardened martensitic area immediately below the surface, and the Knoop reading show that grinding changes the surface hardness. The light area just below the surface is the result of a temperature change or rise above the critical value needed to harden the structure upon rapid cooling. This is verified by the slight increase in the hardness reading as shown by the shorter Knoop impression. The hardness readings starting from the surface are 39, 30, 43, 48, 50, 49, 52, and 53 Rockwell "C".

Lapping is a promising means of surface finishing. A flat surface that conforms to its mate can be created. A very fine surface finish can be obtained, and surface pattern can be sufficiently broken up. One of the difficulties is that there is no equipment built to handle any but the simplest slide surfaces.

Superfinishing is another promising means of surface finishing. While it has been chiefly used on cylindrical surfaces, it will produce very similar results on flat surfaces. Superfinishing will create the smoothness required for a perfect sliding bearing plus the lack of surface pattern. In addition, the metallurgy of the surface will be unaltered by the process. The Germans have done some work with this method even on steel ways.

Figure 5 is a photomicrograph showing the results of Superfinishing to a 14-16 micro-inch rms reading. The Knoop reading shows that Superfinishing does not change the surface hardness. The tempered martensite has not been disturbed and starting with an original heat-treat hardness of 53-55 Rockwell "C", the readings are, starting from the surface, 55, 54, 55, 53, 55, 54 and 53 Rockwell "C".

Surface Contamination

An interesting sidelight is provided by the topic of surface contamination. Research men have found only rare instances in which the metallic bearing surfaces were uncontaminated. G. I. Finch discovered that surfaces become coated on sliding with an amorphous substance, the so-called Beilby layer. Without this layer, metallic bearing surfaces cannot slide but weld solidly together when brought into contact. In the absence of plastic flow, the oxide layers remain intact and prevent cohesion of the metals.

Lubricants

In sliding motion there are three conditions: thick-film lubrication; boundary lubrication; and dry surfaces. The geometry of machine tool slides makes it impractical to separate the sliding surfaces with thick-film lubrication, so boundary lubrication must be used. In boundary lubrication, the resistance to motion arises solely from the viscosity of the lubricant. Clearly, the lower the viscosity the lower the viscous resistance. There is, nevertheless, a limit to this, for as the viscosity is decreased the distance of nearest approach diminishes. If this becomes less than the height of the surface irregularities, penetration of the hydrodynamic film occurs.

In order to reduce the resistance of one material to sliding upon another, lubricants are applied to the

Fig. 4. Visual study and hardness readings on this sectional ground part, heat treated to 53-55 Rockwell "C", show that grinding can change the surface hardness.

mating surfaces. Since the oil film deposited on a sliding surface is so much thinner than the asperities of a commercially prepared surface, it cannot offset welding in even the best prepared surfaces; but it can reduce it considerably. Sliding surfaces are the most difficult of all types of bearing surfaces to lubricate efficiently. There is but little of the clearance wedge action in their operation, and it is mostly the static or inherent viscosity of the oil or grease that keeps the metals apart (if they are). In horizontal sliding surfaces, the weight of the upper member tends to squeeze out the oil, while in vertical sliding surfaces the force of gravity helps to remove the lubricant. This is one reason that special way lubricants have been developed.

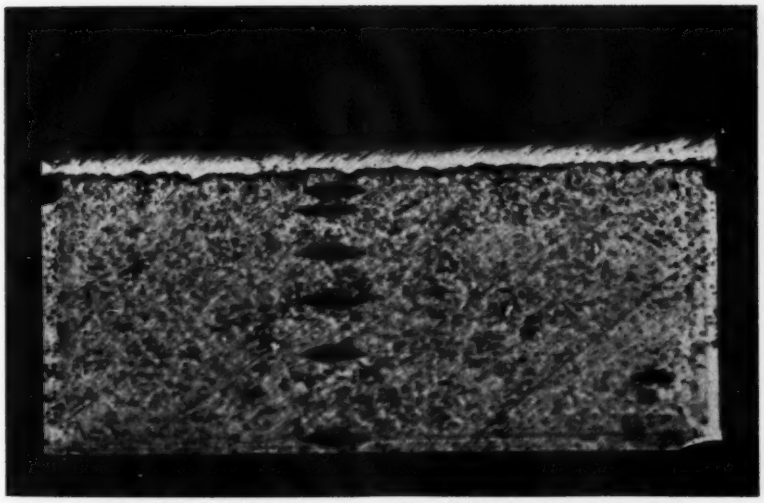

Fig. 5. Similiar observations on a Superfinished part indicate that hardness is not disturbed by this finishing process.

Hardness of Mating Materials

One of the subjects which comes up frequently in any discussion of the design of sliding surfaces is that of the effect, if any, caused by hardness of the mating materials. A. J. W. Moore and W. J. McG. Tegart[3] state that although hardness has little effect on friction, there is evidence that in general the friction is less with harder metals. Bowden, Moore and Tabor (1943) have shown that the coefficient of friction is equal to the ratio of the shear strength and hardness of the sliding metals.

If the surfaces in contact are quite different in hardness, the surface finish of the hard member is important, for the soft high spots on the other member will deform plastically to fit more or less the original roughness of the hard high spots. The original surface roughness of the soft high spots will be obliterated by plastic deformation, and the interlocking effect depends largely on the original roughness of the hard high spots.

In Conclusion

Slide designs should be restudied in light of our present knowledge of materials and slide mechanics. The phenolic laminates have a definite place in slide construction. Thin sheets can be bonded to stiff backing to eliminate seizure due to moisture absorption. The material, due to its very nature, has a homogeneous surface which will overcome seizure due to hard and soft areas as found in some metals.

Scraping could be eliminated if the mating surfaces could be machined flat and parallel. Oil pockets created by scraping are not necessary if one of the materials used in the bearing has the capacity of retaining the oil, due to its surface finish or its ability to conform to its mating surface. Teflon has this characteristic.

The slightly higher cost of some of the newer materials can be offset by the reduction of the machining time required to prepare them and by the fact that wear and consequent replacement of costly parts is reduced.

Much knowledge of this subject is still lacking. If more persons become aware of the problems of designing a good sliding surface — one that consumes the least power and moves smoothly under all imposed conditions — and pool their knowledge, everyone will profit. end

Readers' comments on the information in this article, and additional evidence on the subject of "sliding bearings" will be welcomed by the Editors of TOOLING & PRODUCTION, P. O. Box 3505, Cleveland 18. Such communications will be considered for later publication and will be forwarded to the author of this article.

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TRANSFER LINE BUILT TO MACHINE RAILROAD CAR WHEELS

The world's first automated, five-machine transfer line that will perform complete machining of railroad car wheels, producing at a rate of one wheel every 90 sec, is being built by Kearney & Trecker Corporation.

Designed for the Standard Steel Works, division of Baldwin-Lima-Hamilton Corp., the new transfer machine will introduce a new concept in handling the wheels in vertical position. Railroad car wheels in the past have been machined on individual tools. Now they will be automatically transferred from one station to the next, eliminating a great deal of material handling.

Each of the five machines is actually a separate machine tool interlocked with load, unload, and inspection stations to operate as one machine that will accurately perform the following operations in sequence: (1) loading, (2) rough boring, (3) and (4) facing, (5) and (6) turning. (7) inspection and (8) unloading. The controls system will allow the entire line to be operated as a single machine or enable each machine and intermediate unit to be operated individually without affecting the rest of the line.

PRESS OPERATOR SAFETY

. . . how it's attained

Tooling & Production Magazine — Air Power for Metalworking

by Andrew B. Huntington
Chief Engineer
ROSS OPERATING VALVE COMPANY
Detroit, Michigan
William E. Hoffman
as told to
Associate Editor

"John Q" is looking for a "safe" price tag. Not one inflated by the cost of high accident rates, due to "accidental press stroking."

IN THE USUAL PRESS CLUTCH-BRAKE ARRANGEMENT, the actuating clutch is air engaged; simultaneously the spring-engaged brake is released. Conversely, when the clutch is released the spring re-engages the brake. This provides a desirable fail-safe arrangement. To control the air power for this function, a solenoid operated 3-way valve is usually used. A valve, of this type — a pilot operated poppet type — is seen in Figure 1.

It has 3 ports: an inlet, an outlet, and an exhaust connection, and is a normally closed 2-position valve. In its closed position its solenoid is de-energized and the air pressure through the valve is shut off. When its control valve is closed, the clutch cylinder has been exhausted back through it; the clutch is disengaged and the brake engaged. Other valves that depend on 2 opposed solenoids for positioning the poppet, are not safe since failure of the poppet return solenoid or its signal would mean a press-repeat.

Where any single valve is used to control a clutch-brake setup, any failure of the valve to return to its normally closed position, at the proper time, may cause a press-repeat. This is not always the case however, since, if the inlet orifice partially closes while the exhaust orifice remains partially open, the exhausting capacity of the valve may be great enough to reduce the cylinder pressure to a safe value. This added safety feature is usually provided for by an over-sized exhaust port.

In a direct solenoid operated valve an unsafe condition can be caused by the freezing of the solenoid in its energized position. Also, the failure of a return spring or some internal mechanical interference could cause trouble. In the more usual solenoid actuated pilot operated valve, me-

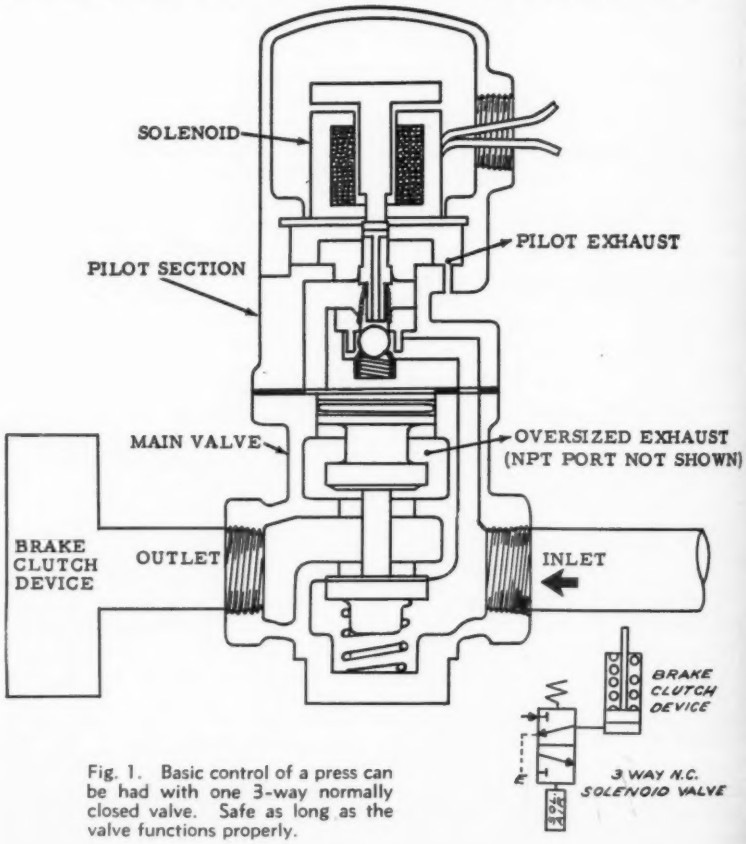


Fig. 1. Basic control of a press can be had with one 3-way normally closed valve. Safe as long as the valve functions properly.

chanical failure in some of the pilot circuitry is an additional possibility.

One method of achieving additional safety is by the use of 2 valves to operate the clutch cylinder. Here the air flows through one and then the other on its way to the power cylinder and the possibility of simultaneous failure in both valves is not likely. Two 3-way normally closed valves diagrammed in Figure 2, are arranged pneumatically in series. The solenoids are in a parallel electric circuit. If either of the valves malfunctions electrically, and remains open, the other valve will exhaust the clutch cylinder and stop further press action.

Although this approach to safety is close to a good answer, a fallacy still remains: There will be no audible or operational indication of a malfunction in either of these valves. This makes it difficult to determine when they are stuck in the energized position. And, if one is stuck the press would still be operational through the other valve without the dual protection.

Since the optimum in safety is always desired, and since the simple series method is still wanting in this respect, the next safety provision might be the use of limit switches with valves in series. Modification of valves for this use could be by arranging exterior extensions on the poppets to trip switches. Safety here is improved by the ability of the interlocked switches to shut-off safety valving. This additional safety is contingent upon the finding of a mechanical switch which can offer sufficient life. Magnetically operated proximity switches should be considered for this.

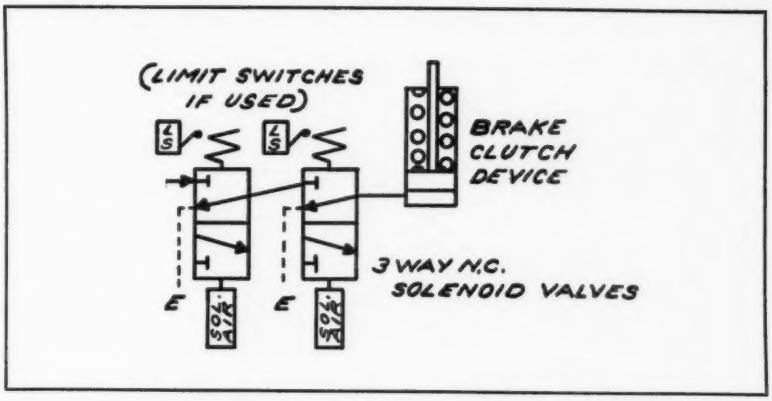


Fig. 2. Two valves in series offer additional safety. Add limit switches to gain even more.

A more simple method of controlling clutch action consists of using two 3-way normally closed solenoid valves in parallel — both pneumatically and electrically. With this parallel arrangement, as is shown in Figure 3, a hazardous condition could exist if either of the 2 valves malfunctions, and remains open, in the absence of the proper electrical signal. Safety in this arrangement then is dependent upon the fact that each valve is equipped with an oversized exhaust. If one valve operates properly and can exhaust sufficient air from the malfunctioning valve, the pressure at the clutch cylinder will be reduced enough to allow the clutch to be disengaged. In this case improper press action will indicate a valve failure, or, this may be noted audibly after completion of a valve cycle — normally there should be no sound of air exhausting when the press is cycling. Multiple unit valves of this parallel type are presently available.

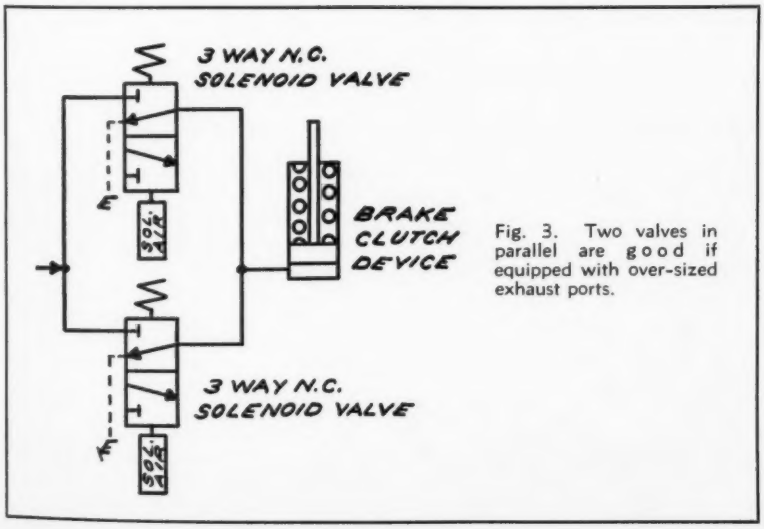


Fig. 3. Two valves in parallel are good if equipped with over-sized exhaust ports.

If another indication of the failure of the above valve is desired, it may be had by an electrical lockout of the valve. This can be done by having a pressure switch connected to a reservoir ahead of the valve inlet and actuated by a pressure drop resulting from exhausting air.

The Ross Lifeguard valve is a dual valve whose function and purpose is the same as the function and the purpose of the 2 valves shown in parallel, Figure 3. One of the many advantages of this valve is simplicity of piping, with the additional feature of an integral pressure-sensing unit. This pressure-sensing unit consists of a spool valve whose one side is internally connected to the outlet chamber of one of the integral 3-way valves; the other end of the spool is connected in a similar manner to the outlet chamber of the other integral 3-way valve. Even at an operating rate of more than 300 cycles/m a pressure unbalance on the ends of the sensing spool will supply pilot air to mechanically lock out the main valve system. A pressure unbalance may be caused by: sluggish opening or closing of either half of the main valve (due to foreign matter), a broken part, or a malfunctioning pilot section or solenoid.

Thus far we have been speaking of valves that are electrically actuated.

Because of the possibility of an electrical or mechanical malfunction in conventional solenoid circuits a great deal of development work has been underway on what is broadly called "logic function" control. Also, a great deal of interest has been generated toward *all-air* control circuits. Developments in these circuits include such features as 2-hand or 2-station control, emergency stop, top stop, continuous cycling, inching or jogging, single stroking, and guard device interlocking. Two valves for

all-air circuitry will be discussed here.

One of these valves is used for controlling the start of a press cycle, wherein it is mandatory that the press operator use both hands, simultaneously, to initiate each press cycle. This valve, which Ross calls a Non-Tie-Down valve, is made up of 2 identical halves. Each half has its own inlet. An outlet is common to both. It is used with two button-type pilot valves (2) of a 3-way normally closed construction; each valve is for the purpose of supplying pilot air to respective sides of the Non-Tie-Down valve. If the air flowing through the Non-Tie-Down valve from each side is not balanced, one of the valve pistons will shift and exhaust all pressure which would normally go to the clutch cylinder.

The second of the *all-air* safety valves discussed here is called a Single Stroke valve. It is placed down stream from the initiating valves and, as its name implies, allows the press to stroke only once. See Figure 4. The first pressure passing through the Single Stroke valve allows the pilot line to the pilot operated clutch cylinder valve to be pressurized and then it automatically closes. The Single Stroke valve remains closed until the cam operated Top Stop valve is opened by the cam on the press shaft, and the outlet (downstream line) from the Single Stroke valve is relieved of its pressure. Also, before the Single Stroke valve can open again the manual start valves must be closed in order to exhaust the pilot line on the upstream side of this valve. This is necessary so that its right hand pilot cylinder will be free to move to the right when the next cycle starts.

It should be noted however that although this Single Stroke valve indicates only one stroke per cycle, the press would continue to stroke until the operator takes at least one hand off the manual start valves. With the Top Stop valve the press stops open; without the Top Stop valve the press would stop but perhaps in an undesirable position.

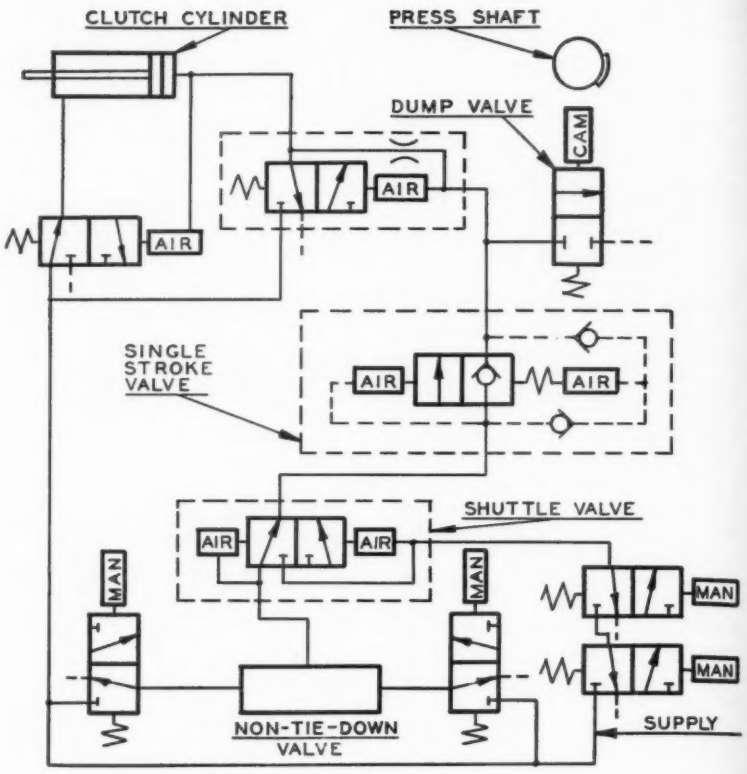


Fig. 4. The use of a Non-Tie-Down valve, a Single Stroke valve, and a Dump valve (operated from the press shaft) approaches the ultimate in press operator safety. Here the Shuttle valve is only used in case of a foot or hand control option (shown).

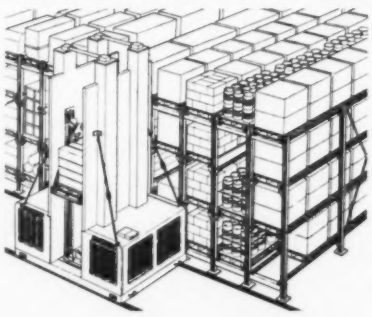
Further safety may be had by using a cylinder operated gate-guard interlocked with the starting elements. In this instance, two hands are occupied by manual start valves to initiate a cycle that is automatic from the time the gate-guard reaches its closed position.

Although there are a great many circuits for press operator safety only a few can be discussed here. However, understanding these few should help in the appraisal of your existing safety facilities, and also in the consideration of future steps in this direction. end

RESERVE STORAGE WAREHOUSE FEATURES PUSH - BUTTON CONTROL

A new concept in reserve storage warehousing takes advantage of palletized storage of goods and offers semi-automatic or fully automatic operation. This new storage system, announced by the Automatic Warehousing Branch of Pesco Products Division, Borg-Warner Corporation is now ready for distribution.

The sketch shows the modular or "building block" construction that has been utilized. The racking system consists of a series of sloped rails supported at regular intervals by uprights. The space formed by the rails and uprights are called cells. The rack is served by an automatic loader at one end and an unloader at the other. They move on tracks which parallel the rack face. Pallets are mounted in specially designed pallet carriers.



In a typical loading cycle, the operator "dials" row number and cell height to identify the cell location to which the loader is to deliver the pallet. The load is automatically picked up by the loader unit which moves to the designated cell. As the loader advances, it determines the correct row by means of a photoelectric cell counting system.

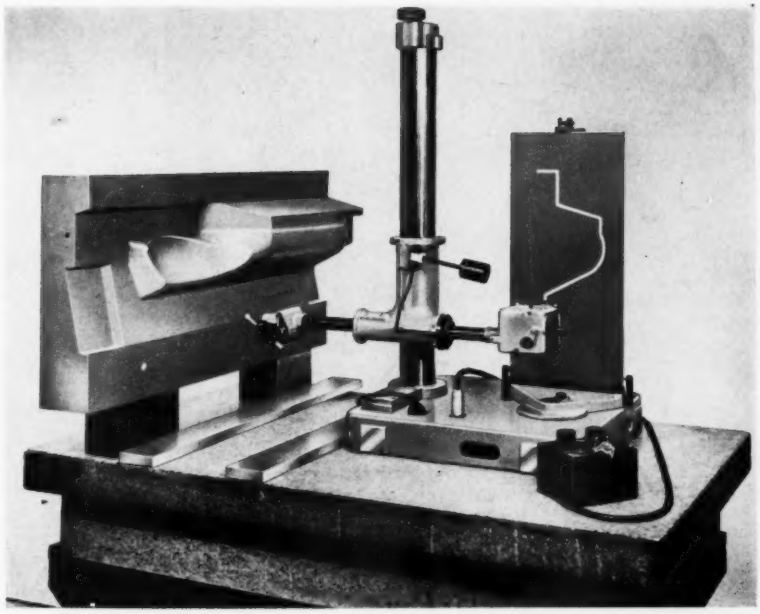


Fig. 1. With this setup, the contour to be reproduced and/or measured is scanned and transferred as a "trace" on the glass master. Complete and continuous reproductions can be made of contours up to 8" deep and 18" long.

Optical Inspection of Intricate Contours

NON-DESTRUCTIVE "SECTIONING" of intricately contoured parts such as turbine blades is made easy by a contour transcriber (Model 8-18) which makes a permanent record on specially coated glass, of contours of master patterns, models, dies, molds and similar parts.

The contour reproduction on the coated glass is called a "trace." It is a complete and continuous reproduction of a part contour, as shown in Figure 1. Traces can be made of both exterior and interior contours, top and bottom halves of a die, and mating parts. Traces are measured by determining X-Y coordinates on conventional contour projectors, by comparing with a grid, and by comparing to a master screen outline or reticle.

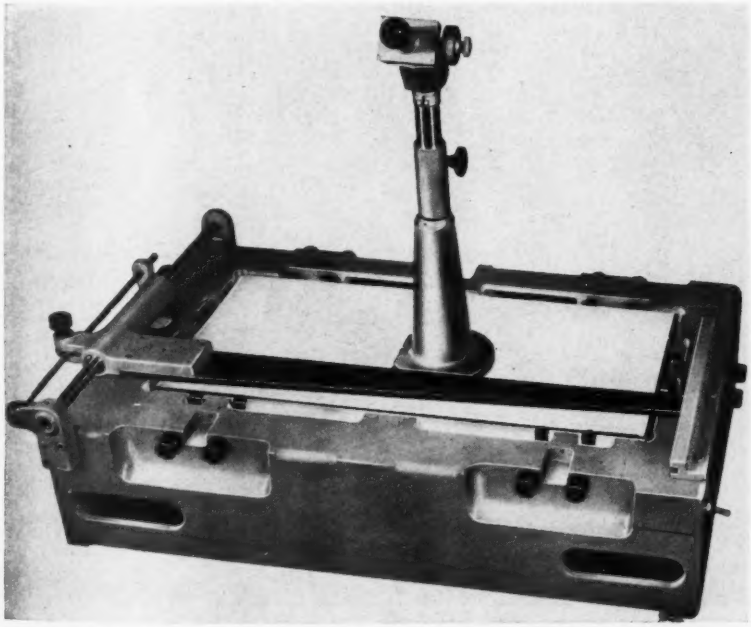
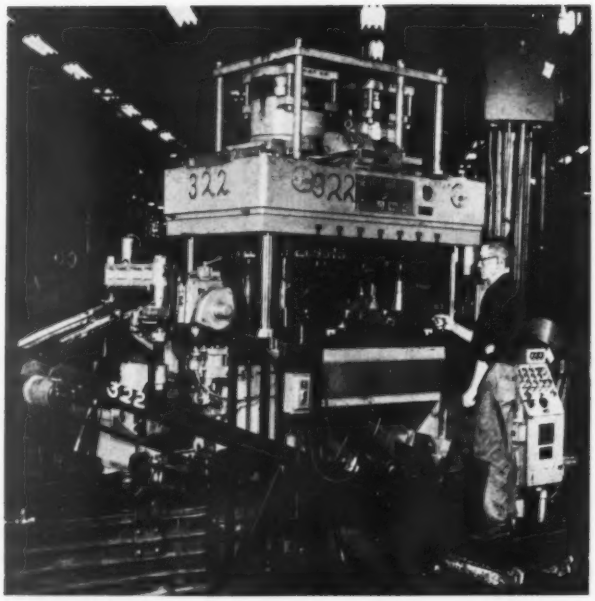


Fig. 2. The special measuring viewer has a precision grid glass, illuminated from below. By superimposing the workpiece trace on the calibrated grid and scanning it with the measuring microscope, as shown, scale readings to an accuracy of 0.0001" can be made of the trace in terms of X-Y coordinates.

The new instrument is designed for rapid, semi-automatic operation and handles contours up to 8" deep by 18" long. Traces on glass may be retained as a permanent record, or the glass may be recoated and used again.

Companion accessory to the contour transcriber is a contour trace measuring viewer, Figure 2. The unit is designed to facilitate measurement and evaluation of contour traces, and is provided with a precision grid glass illuminated from below by a special cold neon tube. Scale readings to 0.0001" are possible, using the grid and its associated measuring micrometer. The transcribers and viewers are the answer to many difficult contour inspection problems. They simplify gathering and classifying engineering data, and the production of duplicate gages and tooling, and checking of dies and molds for wear.

end



One of 10 Henry & Wright 150-ton double crank Dieing Machines at Buick. Photo courtesy Hydraulic Press Manufacturing Co.

by Herbert Chase, M. E.

Why use many single-operation jobs on a press when a progressive die can form a completed part at each stroke? Buick uses Henry & Wright Dieing Machines equipped with progressive dies to make a number of parts, such as those shown below, faster and more economically.

4 Progressive Die Jobs

Save Time and Money for Buick

1 **Part:** Converter Pump Vane

Press: 150-Ton Henry & Wright Dieing Machine

Die: 11-Station Progressive

Stock: 0.042" Thick, 4" Wide

Thirty of these irregularly contoured parts are needed in each Buick Dynaflow transmission. They must be precisely contoured, and the nibs on the blanked contours must fit closely in corresponding holes pierced in stamped supporting rings.

Here's how they're made: A hole for precise locating is pierced at the first station and a partial contour cut at the second. In the third, a similar slot is produced on the other side. Completion of blanking is done in the fourth. Forming is done in the next six stations to make sure the parts hold the close form dimensions required. In the final station the piece is severed from the strip.

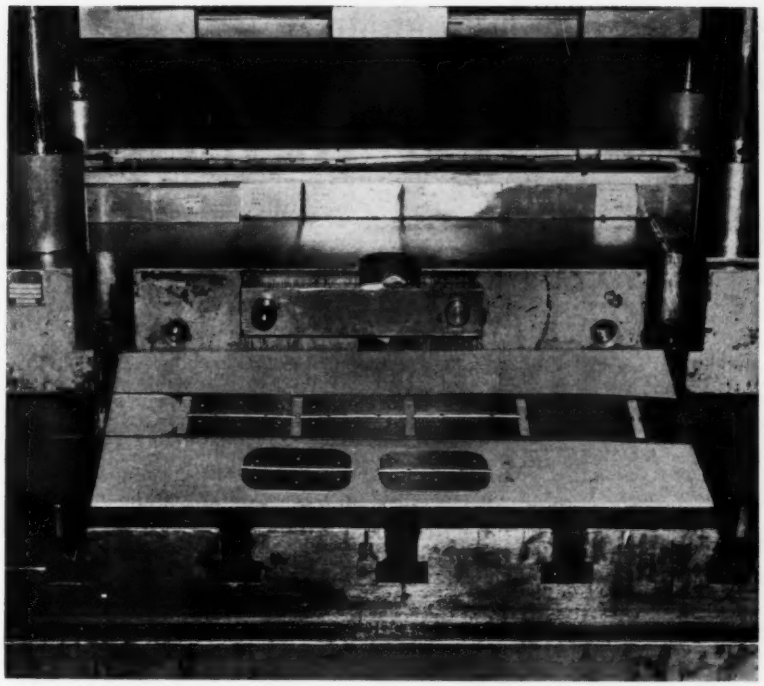
Completed parts fall through the die and the skeleton strips are chopped at the end of the press and fall into a chute to the scrap bin. As with all progressive die work, a finished part is completed at each working stroke of the press.

2 **Part:** Heater Core Deflector Discs

Press: 150-Ton Henry & Wright Dieing Machine

Die: 6-Station Progressive

Stock: 0.0255" Thick, 3¼" Wide



In the first station a cross slot is pierced, partly to permit the forming of the longitudinal rib at the center in the third station, without significantly narrowing the strip. Short nibs are left projecting into the slot at its center. They are formed later at the ends of the rib and are left projecting beyond the ends of the finished piece when, in the final station, it is sheared from the strip with corners rounded.

Two small holes are pierced along the centerline of the piece at station 2 to leave openings for fastening after the rib is formed. At station 4, six other fastening holes are pierced, three in each flat area at each side of the ribs. Station 5 is idle, and station 6 shears the completed part.

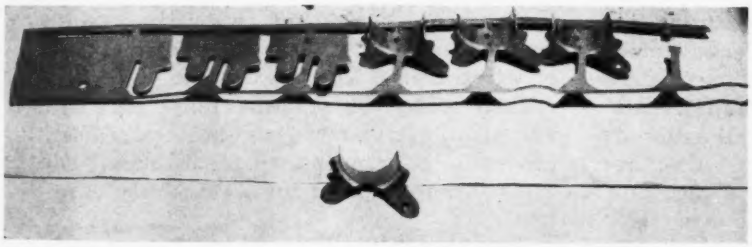
3 **Part:** Tail Pipe Bracket

Press: 150-Ton Henry & Wright Dieing Machine

Die: 7-Station Progressive

Stock: 0.090" Thick, 3⅞" Wide

The tail pipe bracket has a curved portion that seats against the pipe, and two pierced ears formed at right angles to this portion with a considerable radius at the bend. Piercing only is done in the first three stations.



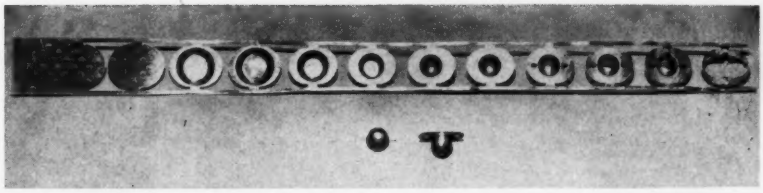
The shearing cuts made in piercing produce the entire contour, except where slender portions are left connecting each side to the skeleton for advancing the piece to subsequent die positions for forming.

At the first form station the curved seat is produced, the ears are bent downward 90°, and the radius connecting them is formed at one end of the seat. Restriking is done at the next station, and then two transverse punches are cammed in to pierce the holes through the two ears. The piece is sheared from the skeleton in the final station and falls through the die in completed form.

4 **Part:** Shield Transmission Count Dial

Press: 150-Ton Henry & Wright Dieing Machine

Die: 11-Station Progressive



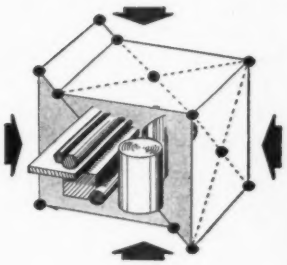
This part shows how drawing as well as blanking and piercing can be done in progressive dies. In the first station a nearly circular blank is formed. This remains attached to the edges of the skeleton until the final station. Lifters raise the strip enough to clear die cavities before stripping and indexing occur.

After the six drawing operations two holes are pierced in the flange, one at each side of the drawn portion. Then, a U-shaped hole is pierced in the dome at the bottom of the draw. In the second last station a square hole is pierced upward through one side of the flange tangent to the cup wall. Final blanking of the flange finishes the piece and it drops through the die.

end

Some Prime Examples of

COLD BENDING TODAY



The cold bending of tubing, pipe, and extruded or rolled sections is superior to hot bending for three reasons: accuracy, economy, and strength.

by B. F. Bower
President
PINES ENGINEERING CO., INC
Aurora, Illinois

GREATER ACCURACY IN THE FABRICATION OF METALS means easier fixturing for subsequent operations, and an easier assembly of components. This increase in dimensional accuracy is available due to the adjustments provided on bending machines, and the ease of their use, since heat is not involved. Also, the absence of heat precludes warping that can take place after the workpiece leaves the machine.

When forming *cold*, the elimination of heating operations saves the expense of equipment for this, as well as the additional benefit of doing away with the extra time involved in the handling of hot materials.

Increased tensile strength and hardness are gained too from the cold working of the metal; yet in those few cases where it is required, impact strength can be increased by stress relieving the cold formed parts.

During any bending operation the material being bent has a tendency to relieve its stresses in any direction available. Consequently dies must be designed to confine the work from "taking off" in unwanted directions. Also, due to residual stress, some warpage could be expected. However, this can be compensated for by proper die construction; this is true whether the workpiece is pulled around a rotating form or wiped around a stationary one.

Then too, tendencies toward unwanted shape variations, due to differences in metal temper, can easily be compensated for by simple adjustments in the bend angle. It is easy to see

Fig 1. Seat support for station wagon is accurately formed to two different radii in same setup. Approximately 125 pcs/hr are produced in ½" dia steel rod.

Fig. 2. Extruded aluminum handrail for a "moving sidewalk" is shown here. During bending, the legs are held to size by insert mandrels.

how this positive control has it over hot forming methods where stresses develop during cooling and cause unpredictable "walk."

The part shown in Figure 1 is a seat support used in a station wagon. It is made of ½" dia steel rod and has four ½" rad bends and one 7½" rad bend. On the standard bending machine shown, accuracy of the part is more easily controlled than was possible by previous production methods; thus, its use in an assembly is simplified. In order to speed up production the dies used to form this part were stacked so that both the ½" rad bends and the 7½" rad bends could be made on the same setup. Yet, tooling costs for this operation were much lower than those where other bending methods were used. This machine forms 125 complete pcs/hr.

The aluminum extrusion shown in Figure 2 was also cold formed on a standard bending machine. This extrusion is used for a handrail on a "moving sidewalk" built by Stephens-Adamson Manufacturing Company. In this bending operation the dies confine the legs which would otherwise spread apart while the 12" rad is being made. Also, mandrels are used to fill the small slot in each leg to prevent them from closing up; if not maintained, a varying slot width would complicate assembly of the railing with sheet metal sides.

Both the channel shown in Figure 3 and the square tubing shown in Figure 4 were formed on the same bending machine with different sets of tools. The channel shown is 4" x 5.40-lb steel, and was formed to a 3½" inside rad without warping the legs. This would hardly be possible with a hot forming process. The square tubing is 4" x 5¼" with 0.200" wall thickness, and is used as a frame member for a truck air-cushion. It is essential that this piece be formed without wrinkles and without bow in its sides so that it can be assembled easily in a truck frame, and also in order that none of the structural strength of the shape is lost. On the bending machine shown a mandrel placed inside the tube at the bend tangent point prevents the walls from collapsing, while the dies which are made to confine the tube on all sides, prevent the walls from bowing.

The heavy steel part shown in Figure 5 was previously bent in a hot forming process, but cold bending is now producing much more accurate and uniform parts. The parts are made of hot rolled steel, 5½" wide x 1¼" thick and are formed to a 10¼" rad. With one operator, production is 12 pcs/hr . . . much faster than before. Heating equipment and the necessity of handling these heavy parts hot has been completely eliminated. After

Fig. 3. Tooling confines legs of this 4" steel channel to produce bends without wrinkles or distortion. The channel is used as part of a truck frame.

Fig. 4. The machine shown here is the same as is seen in Fig. 3. It is set up to bend a 4" x 5¼" square tube having a 0.200" wall. The part is used in a truck air-cushion assembly.

bending, the accurately formed pieces are welded on large steel rings, to serve as supports for a road grader scraper blade.

One of the most recent applications of cold forming on bending machines is that of forming ducting for aircraft. Today's aircraft use a great deal of odd shaped ducting for ventilating, heating and conduit. Bending has many advantages in preference to making turns by fittings. Ultra-thin wall tubing (wall thickness from 0.010" to 0.035") is being formed in sizes up to 8" OD. Further, cold bending is replacing the conventional half-shell drop hammer method of fabricating radial sections in tubing. That method was much slower plus the fact that the half-shell elbows had to be welded together by an expensive heliarc process, and then they still had to be welded to the straight sections of tubing. Here individual dies were required for each tubing size, as well as different dies for each bend angle. Today's bending machines require only one set of tools to take care of all angle requirements for a given tube size. And, no intermediate inspection process is necessary.

The number of shapes that can be formed on a bending machine is almost infinite, with tooling costs that are usually much lower than the tooling for other forming methods. For these reasons cold bending is playing an increasingly important part in modern manufacturing methods.

end

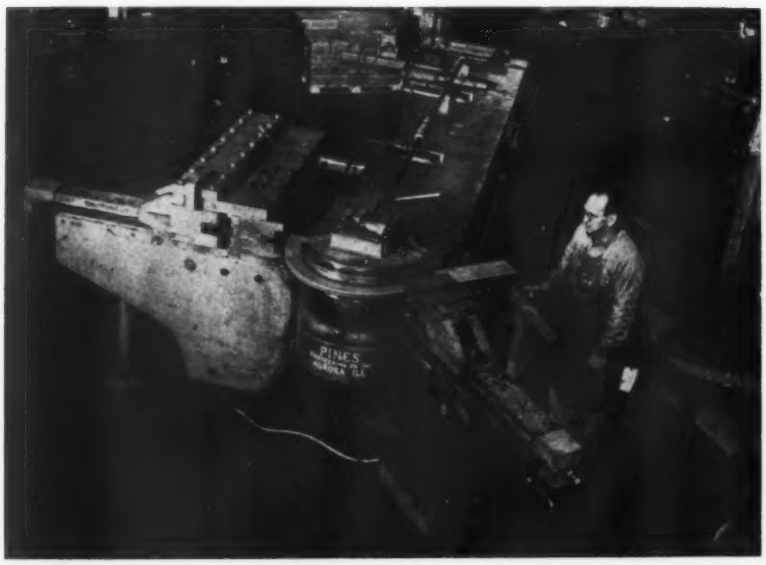


Fig. 5. Here cold bending of a heavy hot rolled steel piece 5½" wide and 1¼" thick is shown. This method replaced former hot bending method at considerable savings.

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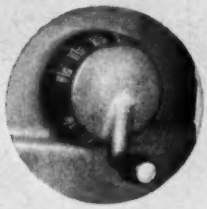
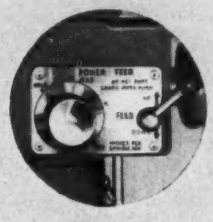
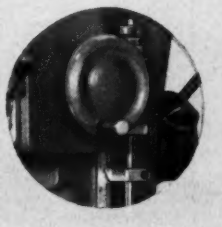




For boring and drilling operations, you'll want power feed to quill, at slight extra cost. Three feed rates; knob selected; up and down; .0015", .003" and .006" per rev.

Quill feed handwheel, mounted on front of the spindle head, advances the quill in fine feed progression. A lever on the right-hand side quickly advances or retracts the quill.



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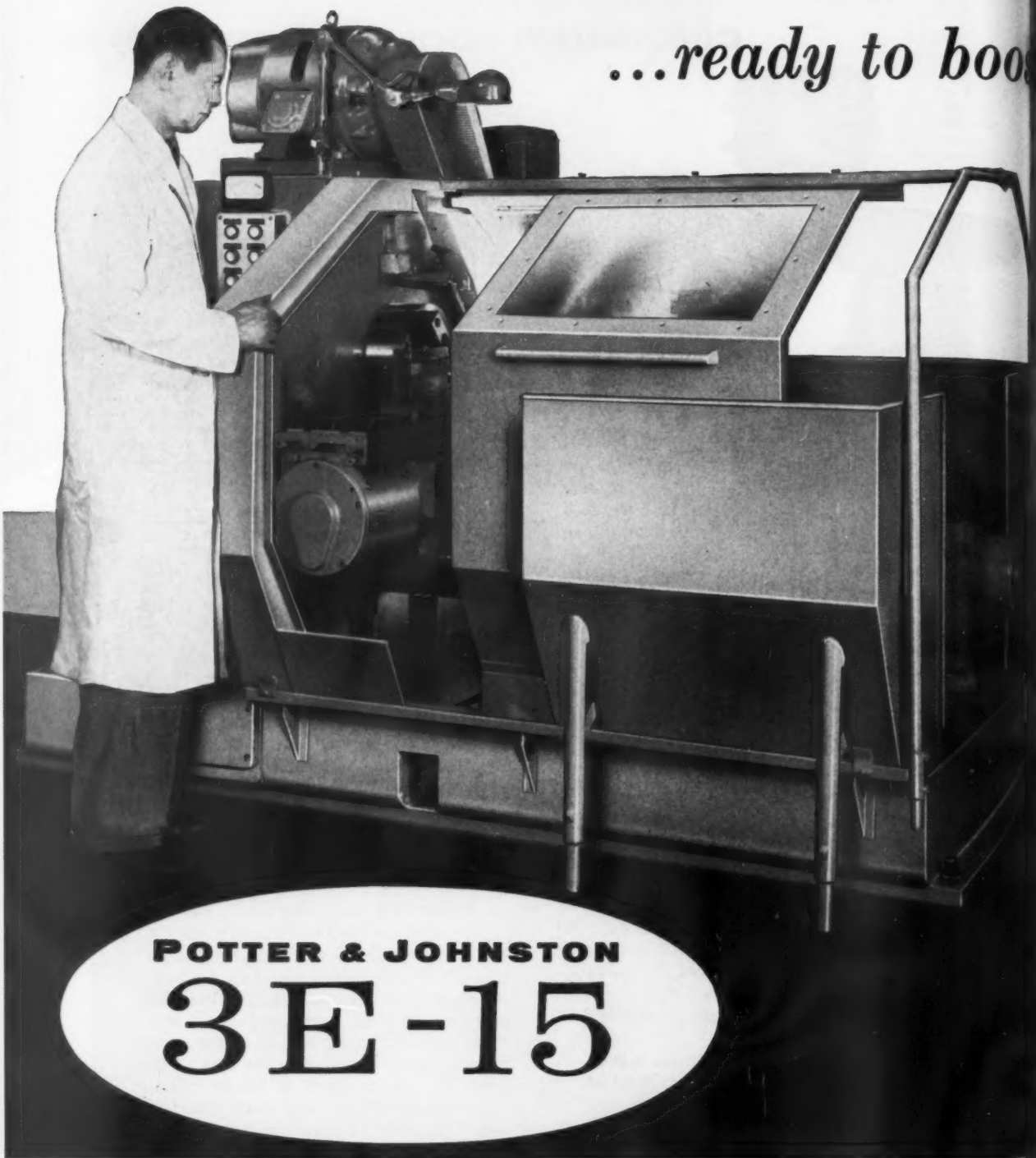

POTTER & JOHNSTON

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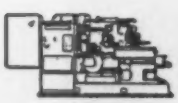
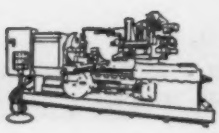


AUTOMATIC
TURRET LATHES



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- **TURRET COOLANT SYSTEM . . .** in addition to overhead system. Lets you pump coolant through turret tools for maximum efficiency in drilling, boring and other internal machining operations.

FASTER SET-UP

- **NEW CROSS SLIDE CONTROL . . .** with selector switches now provides faster, easier set-up for delayed or on-time movement. Cross slides can be operated together or independently with any turret face and can be adjusted longitudinally, independent of each other.
- **NEW INDEPENDENT MOTOR DRIVE FOR TURRET INDEXING . . .** permits indexing during set-up without forward travel of the turret.
- **EXTRA-LARGE CONTROL DRUM . . .** located for easy access, insures fast programming of all machine functions including automatic speed and feed changes, rapid traverse, etc.
- **6-FACE TURRET . . .** allows opportunities for greater tooling flexibility.

REDUCED MAINTENANCE

- **ELECTRIC CLUTCHES THROUGHOUT . . .** are self-compensating for wear, require no adjustment.
- **CENTRALIZED AUTOMATIC LUBRICATION . . .** for turret slide, cross slide and base, reduces wear and insures smooth operation of all moving parts.

SEND NOW FOR THE FACTS . . . *mail this coupon today for your free copy of Bulletin No. 172. Contains complete data and specifications on the new Potter & Johnston 3E-15 Automatic. If you prefer, ask a P&J Representative to call and discuss its advantages with you. There is no obligation, of course.*

POTTER & JOHNSTON COMPANY
Newport Avenue, Pawtucket, Rhode Island
Without obligation —

☐ Please send my copy of Bulletin No. 172, with all the facts on the new P&J 3E-15 Automatic Turret Lathe.

☐ Please have a P&J Representative call and show how a P&J 3E-15 can help me cut costs.

name_____

position_____

company_____

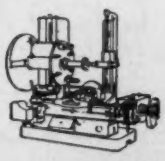
co. address_____

city_____ zone_____ state_____

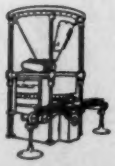
JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898



GEAR CUTTERS



PACKAGING MACHINES

How to be SURE about Surface Roughness

NO NEED TO GUESS or wonder about the roughness of parts that you make or buy. With the PROFILOMETER® at hand, you KNOW the roughness, because —

1 The Profilometer *measures* surface roughness in definite *microinch units* (arithmetical or r.m.s. average height). It eliminates the errors and uncertainties of inspection by touch or sight.

2 It is *accurate* and *dependable*—even below 3 microinches. Cannot be set to give wrong readings.

3 It's a sturdy, portable SHOP TOOL — as easy to use as a dial gage.

4 It is *versatile.* Measures almost *any* surface, internal or external, over any desired length. Measures plastics, glass, etc. as readily as metal.

5 It's been *thoroughly proven* in thousands of production and inspection departments — *since 1936.*

FREE ILLUSTRATED BULLETIN gives details; describes cost-saving applications. *Write for it!*

Representatives in principal industrial centers throughout the Free World

Profilometer is a registered trade-mark.

MMC® MICROMETRICAL MANUFACTURING COMPANY

339 S. MAIN ST. ANN ARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 54

MEN YOU SHOULD KNOW

Newly appointed manager of the Engineering Section of General Electric Company's Metallurgical Products Department in Detroit is **William A. Reich.** His duties include all Carboloy cemented carbide engineering operations for the Metallurgical Products Department.

The establishment of direct sales representation in the Detroit area has been announced by Buhr Machine Tool Co. **L. Bruce Mather** and **Fred N. Martin, Jr.,** will be in charge of this sales outlet.

Appointment of **Frank W. Browne** as new district manager for the West Coast territories of California, Oregon, and Washington has been announced by The Warner & Swasey Co.

The election of **H. W. Whitman** as vice president and general manager of the Machine Div'n, by the board of directors of The Torrington Mfg. Co., has been made known. Whitman previously served as superintendent of manufacturing, assistant general manager, and since early last year, general manager of the division.

Thor Power Tool Company's Aurora Works has announced personnel changes. **Frank Kaman** has been appointed chief air tool engineer; **Peter Rebechini,** chief electric tool engineer; and **James A. Perham,** chief product engineer. New director of the Thor engineering laboratory is **Rex Beach.**

The promotions of **Neil J. Clup** and **Samuel M. Purdy** have been announced by The Carpenter Steel Co. Clup is supervisory metallurgist in alloy development, and Purdy is supervisory metallurgist in metallography.

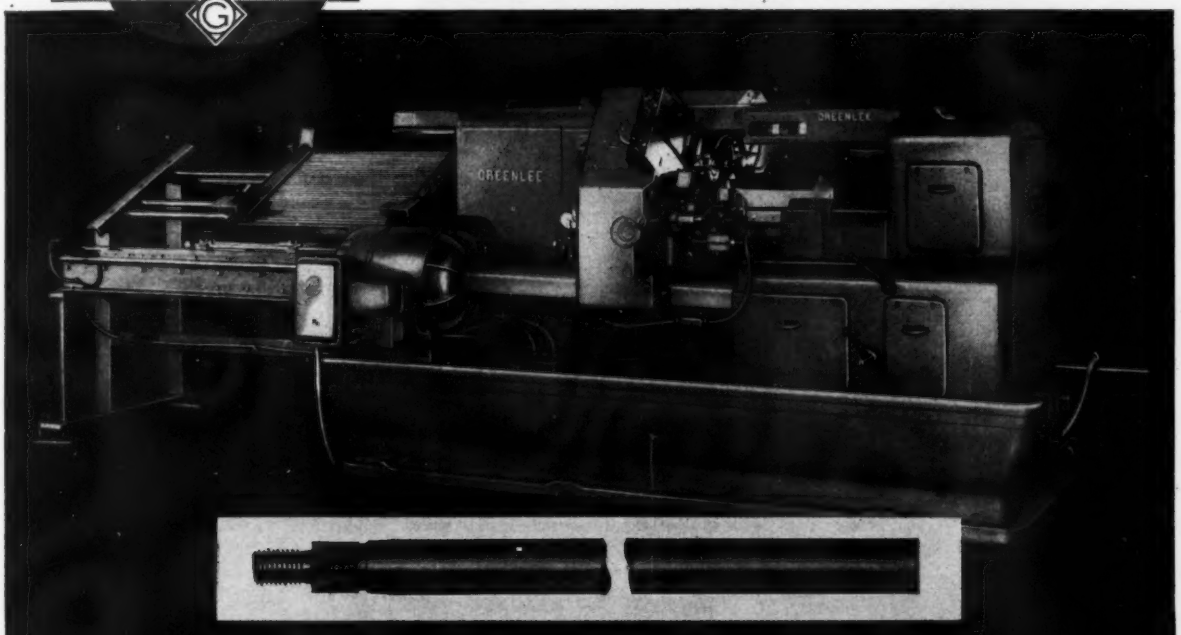
C. B. Hunt & Son, Inc. has announced the election of **Kenneth H. Meyer** as vice president. He was formerly assistant chief engineer and director of engineering.

Assignments for three plant managers have been announced by Chrysler Corporation's Stamping Division. **Roy Blasiola,** former manager of Mack Avenue Stamping Plant is manager of the Ohio Stamping Plant; **Wilfred T. Hanlon,** has moved from the Ohio Plant to Outer Drive Stamping Plant; and **Walter B. Connolly** goes to the Mack Avenue Stamping Plant from the Outer Drive Stamping Plant.

. . . Continued on page 56

PRODUCTION MACHINERY

GREENLEE SHAFT MACHINES



They're Fully Automatic...

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

HANDLE PRECUT SHAFTS UP TO 60" LENGTH

Simultaneous magazine loading and automatic ejection in one position pay off in the machining cycle. Standard tools machine shafts through the five remaining positions.

Special fourth position turning, facing or drilling operations can be performed on the back end of shafts long enough to extend past the back of the spindle. These operations occur simultaneously with normal front end machining.

For greater accuracy, faster setup and production on your long shaft jobs, this Greenlee is the answer! Get the full story from your Greenlee representative.

Write today for Catalog A-405 —
first step on the way to more profitable production
with Greenlee Automatic Bar Machines.

GREENLEE BROS. & CO.

**2047 MASON AVE.
ROCKFORD, ILL.**

CIRCLE INFORM-A-GRAM KEY NO. 55

AO SPENCER

Stereoscopic Microscopes help Allen-Bradley Co. increase production and cut costs

Here's how the Allen-Bradley Company of Milwaukee, Wisconsin applies AO Stereoscopic Microscopes to push the production of potentiometers up, and costly rejects down.

Tiny corners of a metal contact retainer, possible trouble spots, are checked with AO Stereoscopic Microscopes for fractures and flaws. Imperfections at this point allow a graphite button to lose electric contact with a graphite ring. This, in turn, causes an open circuit condition and malfunctions of the potentiometer.

Using an AO Stereoscopic Microscope the operator sees a magnified 3 dimentional image of the part under inspection. Minute defects are immediately visible. Costly failures in the completed instrument are prevented by regular spot checking of component parts.

Like Allen-Bradley, many leading manufacturers use AO-Spencer Stereoscopic Microscopes to solve their small parts inspection problems. These easy-to-use instruments require no lengthy operator training. AO offers America's widest selection of Stereoscopic Microscopes for you to pick exactly the right, most economical instrument for your specific needs.

American Optical Company
INSTRUMENT DIVISION BUFFALO 15, NEW YORK

Dept. G 179
Please send Catalog
on AO Stereoscopic Microscopes.

Name _____

Address _____

City _____ Zone _____ State _____

CIRCLE INFORM-A-GRAM KEY NO. 56

"Men" from page 54

Giddings & Lewis Machine Tool Co. has announced administrative changes. **Edgar L. McFerren** has been named vice president of sales; **George K. Cassady,** general manager —field sales for the corporation; and **Walter B. Wigton,** chief engineer of the G&L and Hypro Div'n. Others include **Walter L. McCann,** chief engineer of the G&L and Hypro Div'n; **William M. Ritter,** sales manager of the Davis Div'n; and **Harry C. Soukup,** acting general manager of the G&L and Hypro Div'n.

Appointment of **Oscar Ahlers** as general manager of The Sheffield Corp. has been made known. He will supervise all sales, product divisions, and field service manufacturing facilities.

New president and general manager of the Long Mfg. Div'n of Borg-Warner Corp. and Long Mfg. Co. Ltd. is **L. G. Porter.** He will also continue as executive vice president of Borg-Warner. **Harry H. Wittingham** takes over as general manager of the Long Mfg. Div'n, and **D. Wayne Zimmerman** is branch manager of the newly formed Automatic Warehousing Branch of Pesco Products Div'n.

R. E. Persohn is now serving as general manager of Allis-Chalmers Gadsden Works, succeeding **S. W. Ouweneel,** who is now the general works manager of the Tractor Group.

Newly elected vice president of General Motors Corp. is **Joseph A. Anderson,** general manager of AC Spark Plug Div'n.

Besly-Welles Corp. has elected **Edward K. Welles** chairman of the board of directors and chief executive officer, and **Warren C. Olson,** former executive vice president, president and chief administrative officer.

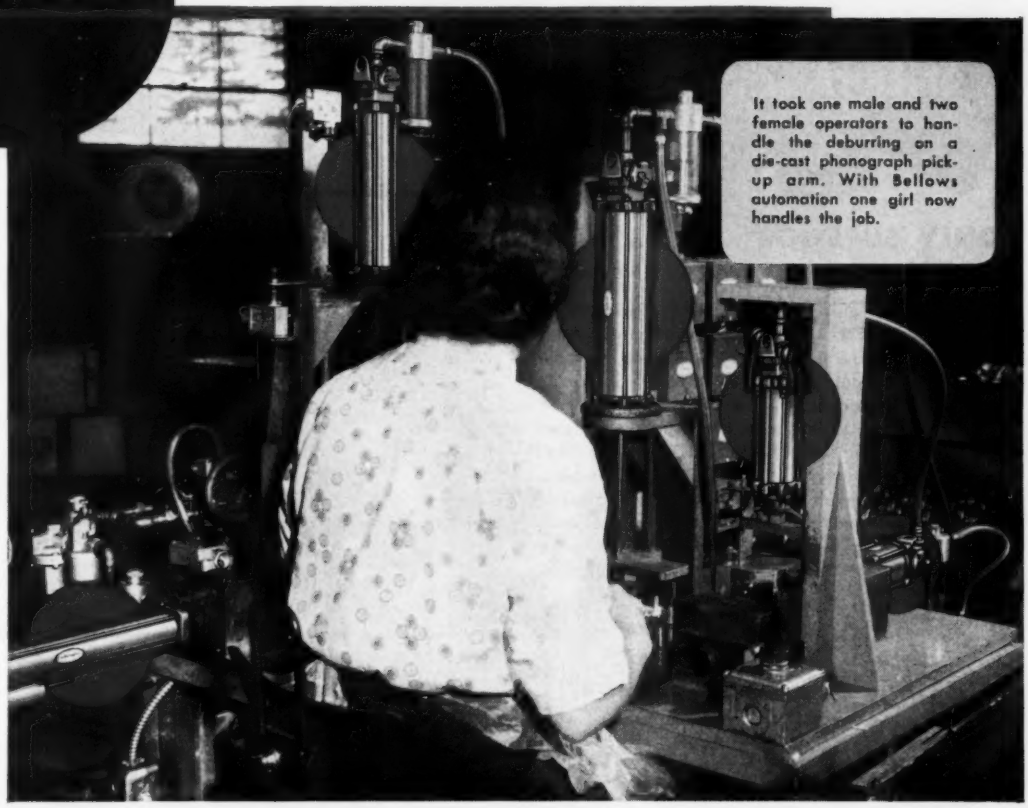
Taking over as vice president and general manager of Chicago Aerial Industries, Inc., is **Marvin B. Ruffin,** who will be responsible for all of the avionic firm's operating activities. **William A. Ziebell** has taken over as plant superintendent.

Leonard M. Kulze has been promoted to factory manager of Associated Spring Corporation's Gibson Div'n, and **Joseph A. Harinek** is chief engineer.

Election of **Robert F. Gladfelter** as president and **John M. Small** as vice president has been announced by Link-Belt Co.

Manager of the new Control Systems Co., Div'n of Hancock Industries, is **Carl S. Saltzman.**

"SPOT" AUTOMATION"



It took one male and two female operators to handle the deburring on a die-cast phonograph pick-up arm. With Bellows automation one girl now handles the job.

. . . a fast approach to important cost savings

Any plant, no matter how large, consists of many "small plants" or separate manufacturing centers. Sometimes these separate manufacturing centers consist of no more than a single operation; sometimes they embrace a group of related operations.

A quick approach to important cost savings can be to "spot automate" these separate "small plants" with Bellows Controlled-Air-Power Devices.

These packaged work units can be quickly incorporated into existing equipment to make it fully automatic; can be used to interlock or program a number of machines or operations; or can form the key components in low-cost, tool room-built, special purpose machines.

A Bellows Field Engineer (there is one or more in every major industrial area in the United States and Canada) will be glad to discuss with you the ways you can use to "spot automate" your plant. No obligation, of course. Phone him (he's in the book under "The Bellows Co.") or write to us in Akron.

Would you like a copy of this booklet?

Write Dept. TP-758. Ask for the booklet—"Automation can fit into Your Picture."

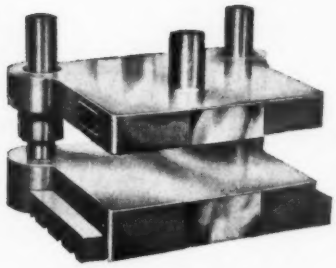
The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

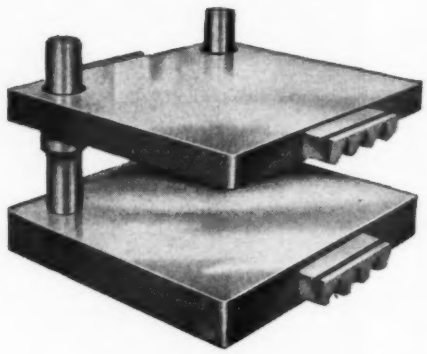
1126-B

HANDLE LARGE AND SMALL DIE SETS SAFER·FASTER·MORE EFFICIENTLY



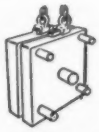
ONLY SUPERIOR *precision all steel*
DIE SETS *offer exclusive safety and handling features.*

Three features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment. **In addition, all Superior Die Sets are jig bored to your specifications — result number of sizes practically limitless.** Write for FREE 24 page Catalog on Superior Die Sets and Supplies.

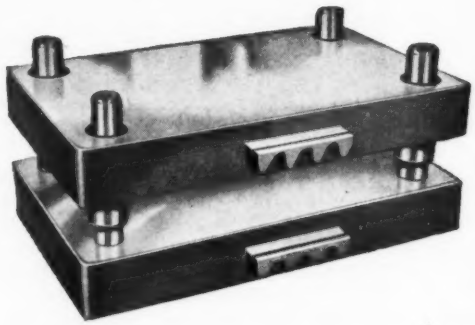


LOCK-JAW LIFTING DEVICE removes the danger of handling large die sets.

SAFETY FLANGE protects fingers by providing roomy gripping space on either side of the die shoe.



E-Z LIFT SLING CHAIN attach to the lock-jaw for immediate lifting.



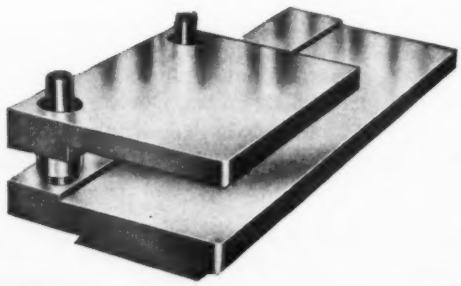
FOR FAST LOCAL SERVICE CALL THESE EXPERT SUPERIOR REPRESENTATIVES

2 PLANTS TO SERVE YOU

Milwaukee, Wis. Mitchell 5-6027

Plainville, Conn. Sherwood 7-2761

Kalamazoo, Mich. Fireside 5-7988	Chicago, Ill. Randolph 6-8871	Caldwell, N. J. Caldwell 6-0337
St. Louis, Mo. Jefferson 5-1223	Memphis, Tenn. Fairfax 3-7727	West Newton, Mass. Bigelow 4-2070
Indianapolis, Ind. Clifford 5-5668	Denver, Colo. Enterprise 234	Agawan, Mass. Republic 9-1132
Rockford, Illinois 3-3931	Winter Park, Fla. 4-0464	Brooklyn, N. Y. Esplanade 6-1368
Dayton, Ohio Hemlock 6208	Racine, Wis. Melrose 2-1900	Cheshire, Conn. Browning 2-4887
Minneapolis, Minn. Franklin 1-1321	Cedar Rapids, Ia. Empire 2-7831	Warwick, R. I. Turner 4-2907

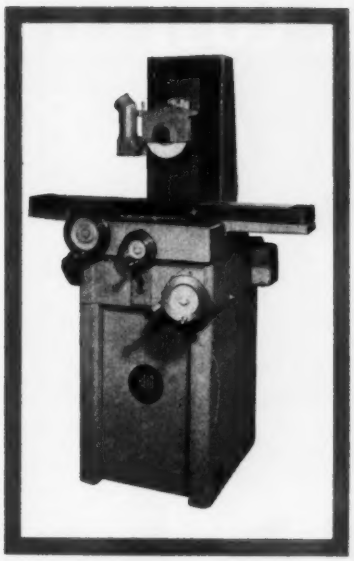


SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

MULTI-SLIDE SETS TO YOUR SPECIFICATIONS

CIRCLE INFORM-A-GRAM KEY NO. 58

IT'S A NEW REID 6-12



Reid's brand new 612 surface grinder is twice the weight of comparable grinders in this size. It incorporates many features heretofore unavailable on a 612 grinder. Standard model offers a timing belt-driven table and a precision anti-friction belt-driven spindle.* Complete underguard dust protection is provided as standard equipment.

Vertical work height is a full 12-½". The center distance on the cross slide ways is 18" . . . a big factor in greater stability and ruggedness. *More*, the new 612 incorporates one shot lubrication, cross slide lock and finger tip controls.

For precision toolroom grinding, ask your dealer for complete details on the Reid 612 . . . or write to us, today!

**Optional features at extra cost*

- Motorized Spindle
- Automatic Lubrication
- J.I.C. Controls
- Chrome Ways

PRECISION SURFACE REID GRINDERS

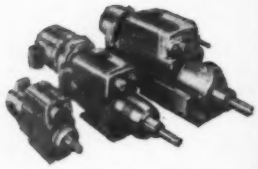
Manufacturers of precision surface grinders for production and toolroom needs

REID PRECISION SURFACE GRINDERS

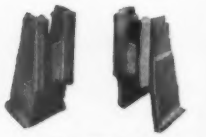
REID BROTHERS COMPANY, INC. / 136 ELLIOTT ST. / BEVERLY, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 59

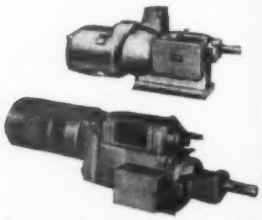
THE COST CUTTING METHODS you need AT A PRICE you can afford



Air Hydraulic Drill Units



Circular Machine Base and Columns



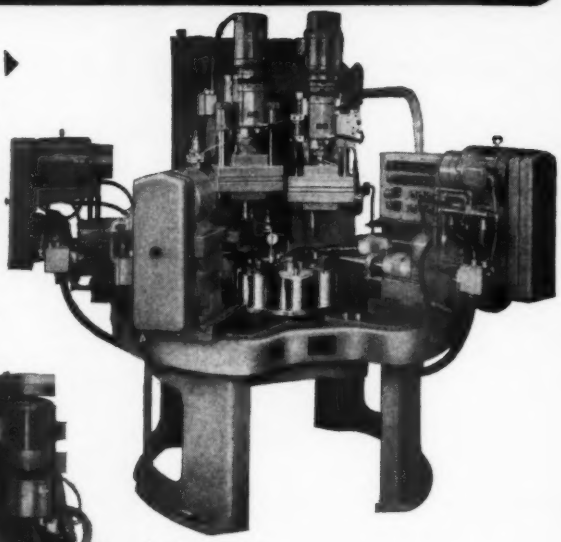
Automatic Lead Screw Tapping Units

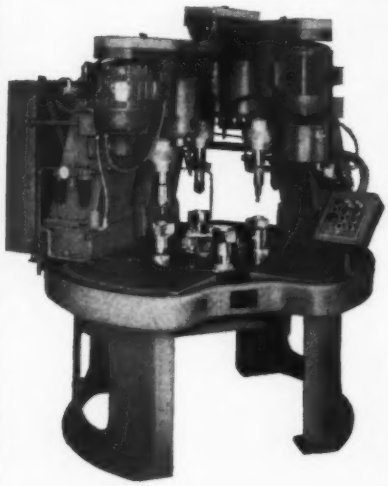
Rectangular Machine Base

EXAMPLE* ▶

A high speed indexing machine to drill and lead screw tap horizontal opposed pipe ports and two vertical mounting holes in stainless steel valve bodies at 320 parts per hour. Standard automatic self-centering Skinner air chucks hold parts.

Photo courtesy of The Skinner Chuck Company

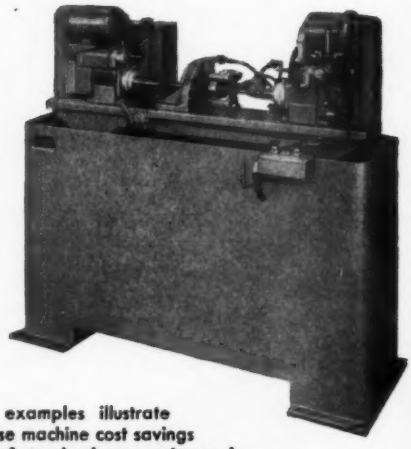




◀ **EXAMPLE***

Combination drill, bore and face plus two tapping operations in die cast regulator valve spring cages. Capacity: 450 parts per hour.

Photo courtesy of Watts Regulator Company



EXAMPLE* ▶

Double end opposed combination ream and face die cast piston plates to close tolerance. Simplified air-manual fixture loading permits production of 423 parts per hour.

Photo courtesy of Bendix Products Division Bendix Aviation Corporation

***Note**

The above examples illustrate single-purpose machine cost savings through use of standard pre-engineered components. The components, bases, columns, adapters and units as shown, are available for machines built by you or for you from Hartford Special.

Write today for full information and name of our nearest field man—a specialist in low cost production techniques.

HARTFORD Special

THE HARTFORD SPECIAL MACHINERY CO.
MACHINE TOOL DIVISION
2927 HOMESTEAD AVENUE, HARTFORD 12, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 60

YESTERDAY'S PIONEER . . . . . TODAY'S LEADER

TAP SHARPENING FIXTURE

For use with end mill sharpening fixture. An inexpensive device for sharpening two-, three- or four-flute taps.

END MILL SHARPENING FIXTURE

For sharpening end mills quickly, easily and accurately. Successfully proved by the many thousands in use.

BALL BEARING SPINDLE

Fits the head of the Weldon End Mill sharpening fixture. For use in sharpening end mills beyond the capacity of regular end mill sharpening fixture.

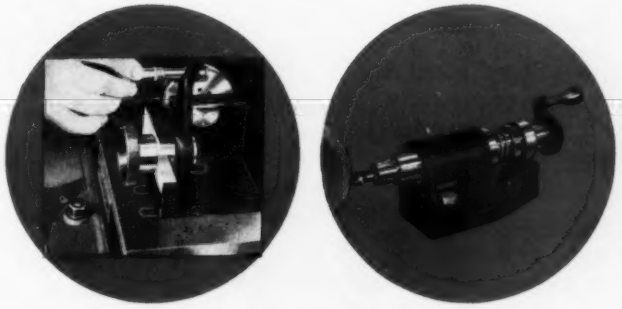
Lends itself to the sharpening of tapered end mills.

WELDON / sharpening fixtures

Best results come from properly sharpened cutting tools. Weldon fixtures help toward that end. Weldon Tool Company, specialists in cutting tools for more than forty years, design and build these tool sharpening fixtures. Ask for complete information on these tool saving devices.

CIRCULAR FORM TOOL SHARPENING AND MEASURING FIXTURE

A study of the photograph will quickly reveal the operation of this fixture.



AXIAL RELIEF SHARPENING FIXTURE

Lends itself to the sharpening of end relieved cutting tools. Especially adapted to the sharpening of Weldon Countersinks and Deburring Tools. (Note Deburring Tool mounted in end of spindle.)

All the fixtures shown above may be used on any grinding machine having a flat table.

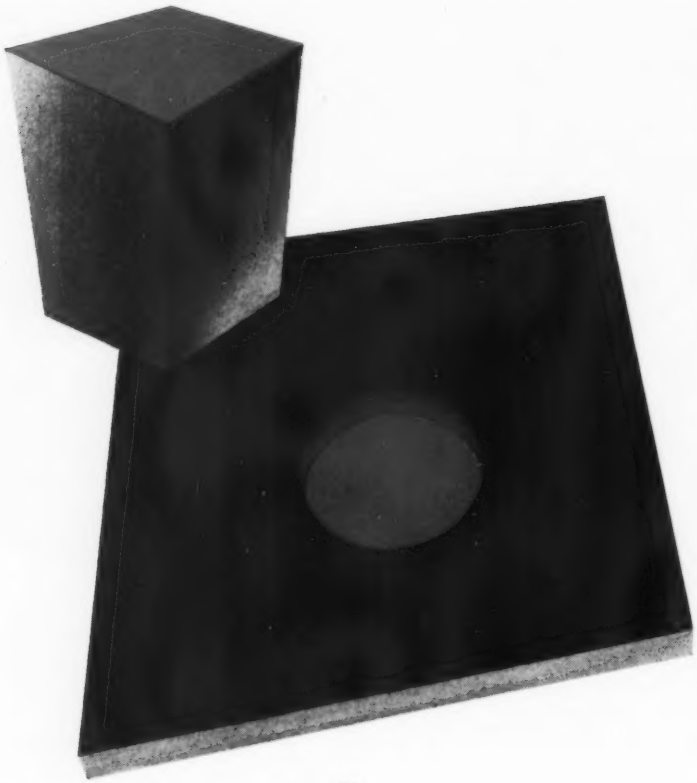
Weldon distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

40 YEARS OF LEADERSHIP 1918—1958

CIRCLE INFORM-A-GRAM KEY NO. 61



Inconsistency!

Does anyone expect perfect teamwork between a straight drill and a ( ) barrelled out or a) (bell-mouthed drill guide? Of course not! That's as inconsistent as looking for close tolerance between a square peg and a round hole.

If your drilling operations demand maximum accuracy,
THINK FIRST OF ACE . . .
the proven superior precision drill guide.

There's an interesting "Inside Story" about Ace Drill Bushings. The walls, inside and out remain consistently || parallel even after long, hard wear. Ace's greater drill bearing surface produces better work with longer life of both drill and bushing.

Ace Drill Bushings are made right . . . to wear right. They guarantee a maximum concentricity of .0003" t.i.r. . . . usually it is far less. You can depend upon ACE Drill Bushings. They are consistently **the best** in every way. **Always specify ACE!**

ACE DRILL BUSHINGS

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ACE

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LOS ANGELES 29
HOllywood 9-8253

ACE

MICHIGAN
10620 West Nine Mile Road
DETROIT 37
Lincoln 8-0777

CIRCLE INFORM-A-GRAM KEY NO. 62

Stanley E. Huffman, Jr. has been appointed to the new position of manager of sales for the Press Div'n of E. W. Bliss Co.

Fred D. Watson is now serving as district manager of the Rochester branch of Pratt & Whitney Co., Inc., while **James H. Daley** has taken over the Cincinnati office.

Cincinnati Milling and Grinding Machines, Inc., sales subsidiary of The Cincinnati Milling Machine Co., has announced the elections of **Philip O. Geier, Jr.,** to vice president and director, and **W. Kent Mathias,** to vice president.

Taking over as Wesson Co. field sales engineer for northwestern Ohio and southwestern Michigan is **Eugene Ploucha.**

New district sales manager of the Cleveland office of Vickers Inc. is **Al Trail.** He replaces **Arthur Van Wormer** who now heads the Detroit office.

August D. Diedrich, Jr., has joined the Michigan district sales organization of the Bay State Abrasive Products Co.

Sales manager of Vidmar, Inc., Div'n of Volkert Stampings, Inc. is **Harry T. Bauerle, Jr.**

Now serving as sales manager for the C. A. Norgren Co. is **Geoffrey Grange.** He succeeds **Frank T. Goll,** who is now district sales representative in Buffalo, N. Y.

James E. Barnes has been appointed sales engineer for indirect field sales by Buhr Machine Tool Co.

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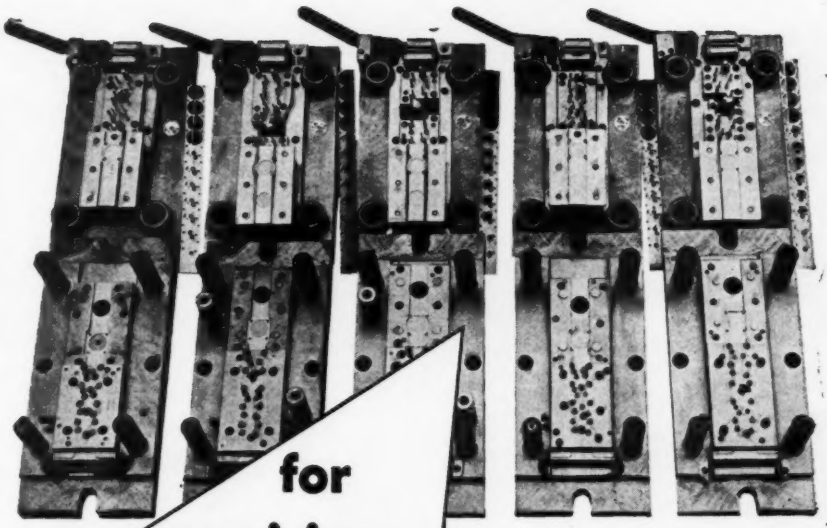
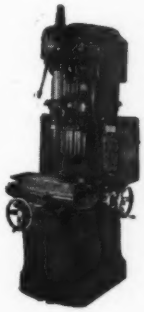
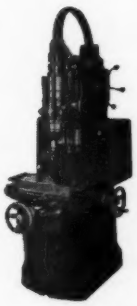


for precision jobs like this....Moore Jig Borers and Jig Grinders are "MADE TO ORDER"



NO. 2 MOORE JIG BORER. Range 10" x 16" x 16" height. Features infinitely variable spindle speeds, three power feed ratios, centralized controls.



NO. 2 MOORE JIG GRINDER. Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up or down; spindle-housing heat control; features slot grinding attachment.

"HOLES, CONTOURS AND SURFACES

is bound to become a classic to the man or shop that does accurate work."

American Machinist Book Review

424 pages — $5 U.S.A., $6 elsewhere

Moore Jig Borers and Jig Grinders are made to order for jobs that require precision hole location—and plenty of it.

Take, for example, these five progressive compound dies used to pierce, shave, gut and blank intricate timing-device parts.

Holes in punch plate and stripper were jig bored in a No. 2 Moore Jig Borer. Holes in the corresponding die parts were jig bored in the same precision machine, hardened and then jig ground in a No. 2 Moore Jig Grinder. Perfect line-up was insured, since all holes had to be held to ± .0002", both for position and hole size.

The No. 2 Moore Jig Borer, with its built-in system of accurate lead screws, can spot, drill, bore or ream all holes in a workpiece to "tenths" with minimum tool changes. The No. 2 Moore Jig Grinder can accurately contour grind, slot grind and form grind die sections in a third of the time required by other means.

These Moore toolroom teammates provide a one-two punch that can knock the fat off your diemaking costs. They supply an *Engineered Hole Location Service* that permits tool and die sections to be produced concurrently...puts diemaking on an interchangeable-parts-and-assembly basis...lengthens die life...*saves you time and money* all along the line.

Write today for our detailed literature that pictures and describes many toolroom and production jobs for which Moore Jig Borers and Jig Grinders are made to order.

MOORE SPECIAL TOOL COMPANY, INC.

726 Union Ave., Bridgeport 7, Conn.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 63

DoALL Announces . . .

a *NEW* Super Precision Hand-Operated SURFACE GRINDER

Tailored to Fit the Operator for Easier, More Productive Work

- **NEW-DESIGN VERTICAL FEED HANDWHEEL** in easy-to-reach, safe position
- **ADJUSTABLE MACHINE OPERATING HEIGHT**
- **SMOOTH TABLE ACTION**—manual traverse through timing belt drive (hydraulic drive optional)
- **RIGHT- or LEFT-HAND TABLE DRIVE**—handwheel position instantly interchangeable
- **VERTICAL HANDWHEEL** graduated in tenths (Zero Slip Rings optional)
- **SADDLE LOCK** for form and plunge grinding
- **1 H.P. MOTORIZED SUPER PRECISION SPINDLE** with anti-friction bearings
- **KNEE-RECESSED** cabinet base

"Human Engineering" guided DoALL engineers in the design of this new surface grinder. Low in cost yet superior in accuracy, it is manufactured to set completely new performance standards in a hand-operated surface grinder.

Every design feature and control function was carefully considered for the operator's convenience. Now the most exacting work may be turned out with least operator fatigue. With tolerances closer than ever before, this assures users of the Model DH-612 a definite competitive advantage.

Standard machine includes not only the exclusive features above, but also telescoping dust guards and one-shot lubrication system to table, saddle, column ways, elevating screw, gears and bearings. A full range of optional accessories is available including "Cool Grinding" through-the-wheel mist coolant system. Table travel is 7″ x 13″; work height, 0 to 12¾″; vertical feed to .0001″ and crossfeed with vernier to .0002″.

In ease of operation, accuracy, power and completeness, there is no finer grinder. Full details are at your DoALL Store—or write . . .

THIS IS A
TYPICAL DoALL STORE

THE DoALL COMPANY, Des Plaines, Illinois

Machines and Blades · Surface Grinders · Power Saws · MACHINE TOOLS · CUTTING TOOLS · MEASURING INSTRUMENTS · SHOP SUPPLIES IN STOCK

The Big REVOLUTION

in punch press design...

is benchmaster's new ELECTRO-MAGNETIC CLUTCH!

Now available on 2, 5, 8 and 10-ton Benchmasters—all series

- Fully electro-magnetic operation
- Instant pickup or disengagement
- Maintenance-free
- No breakage hazards
- No sliding keys or dogs
- No mechanical linkage
- No airlines
- Smooth, relatively noiseless operation
- Positive brake
- Maximum safety

benchmaster

World's largest manufacturer of small punch presses and mills.

1835 W. Rosecrans Ave., Gardena, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 65

chips...or parts

Which are you paying for?

Fenn rotary swaging can have an important role in reducing the cost of your product . . . and making it better. This modern method of chipless part making is fast, versatile, accurate (to ± .001") . . . saves money and metal. Plenty of it! You save in capital investment, labor, material and time. Here's an example—A precision shaft was formerly made from a five piece assembly at a cost of $130.00. Now, swaged from tubing, it costs $20.00 . . . a savings of 85%. To be sure that you are not paying for chips instead of parts, look into Fenn Rotary Swaging. Write for catalog SM58.

FENN *Sets the Pace* IN ROTARY SWAGING

FENN MANUFACTURING COMPANY • 203 FENN ROAD • NEWINGTON, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 66

ASME HANDBOOK — METALS ENGINEERING-PROCESSES, edited by Roger Bolz. Sponsored by the American Society of Mechanical Engineers and published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y., 1958. 448 pages; $13.50.

This is the fourth and final volume of the *ASME Handbook*. It is composed of 45 sections, covering such areas as the heat treatment of steel, casting, hot and cold working, powder metallurgy, welding, machining, and electroforming. For each of the methods covered there is a compilation of the basic physical characteristics to be considered and the general advantages and limitations usually encountered. In addition, concise parallel data concerning the suitability of various metals for each process, and various processes for desired results, are given.

TOOLING FOR METAL POWDER PARTS, by George H. DeGroat. Sponsored by the American Society of Tool Engineers, and published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y., 1958. 256 pages; $7.50.

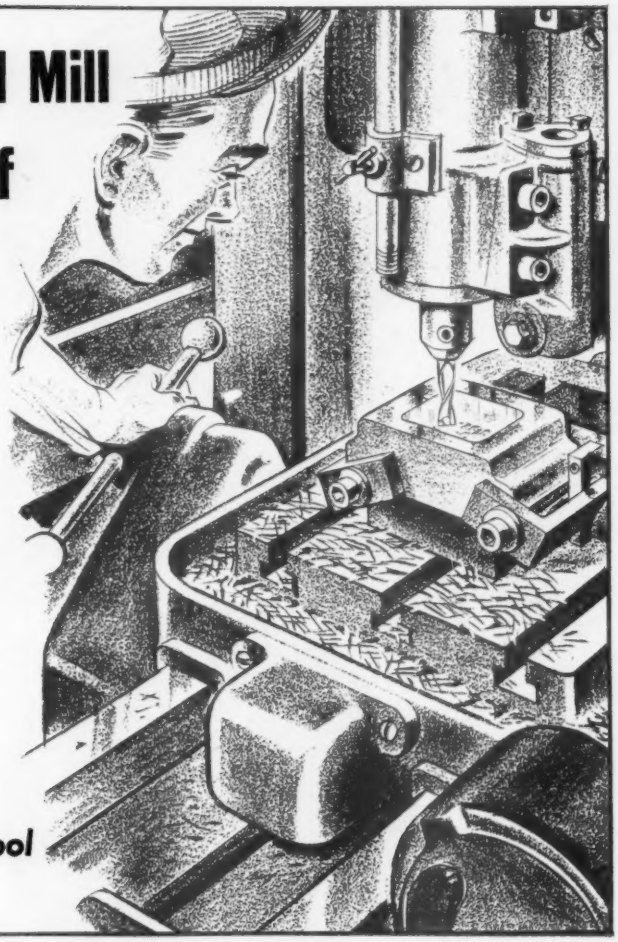
This book gives the latest practical developments in the production of metal powder parts, with emphasis on planning and tooling for structural parts such as cams, gears, and latches. The entire process is outlined and information on metal powder advantages and limitations is included, as well as comparisons with other processes and case histories illustrating the necessary planning and economics. On the technical side, part design, production and preparation of powders, briquetting, and briquetting tools and finishing operations are described.

INVENTOR'S HANDBOOK, by Ernest Zadig, Harry Jursch, and Joseph Kraus. Published by Arco Publishing Co., 480 Lexington Ave., New York 17, N. Y., 1954. 144 pages: $2.

This isn't a new book, but it's valuable to inventors because it tells how to protect an idea, how to raise capital to get an invention into production, how to create a successful invention, when to discard a poor idea, how to avoid court action on patents, and how to protect a trademark or slogan.

. . . *Continued on page 68*

2-Flute CLEVELAND End Mill Solves Problem of DEEP CAVITY MILLING



Rough and Finish Milling now performed with a Single Tool

A midwest manufacturer was production milling a deep cavity in steel forgings. The cavity required ¼" corner radii, but because of the deflection and "whip" encountered in the ½" diameter end mills he was using, it was necessary to rough mill the cavity with a 1" diameter end mill and then finish mill with a ½" diameter 4-fluted end mill.

By changing to a ½" diameter CLEVELAND Long Flute End Mill, as shown above, he was able to rough and finish mill this cavity *with a single tool.* The correct combination of rigidity, rake angle, relief angle and flute shape have been built into this latest addition to the CLEVELAND End Mill Line to enable the user to obtain maximum rates of metal removal with minimum deflection and cutting edge wear, and the virtual elimination of breakage.

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

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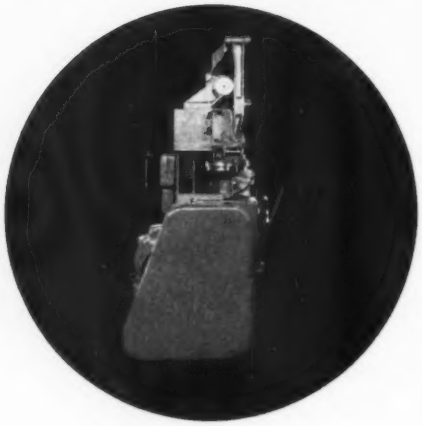
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58 • E. P. Barrus, Ltd., London W. 3, England

CIRCLE INFORM-A-GRAM KEY NO. 67

VERTICALITY = SETUP TIME / 2



The big story of the important new line of Torrington vertical 4-slides is savings:

Upward of 50 percent savings in setup time, tooling costs and floor space!

On a strict cost-accounting basis, you cannot afford not to investigate the profitability of replacement with the Torrington "Vertical Line" in the cost-critical field of wire and strip forming production equipment. Full data—or a demonstration—upon request.

THE TORRINGTON MANUFACTURING COMPANY

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CIRCLE INFORM-A-GRAM KEY NO. 68

"Books" from page 66

HANDBOOK OF ELECTRICAL DISCHARGE MACHINING. Edited and published by Elox Corporation of Michigan, 1830 N. Stephenson Hwy., Royal Oak 3, Mich., 1958. About 450 pages, paper-bound; $12.

The six sections of the Elox Handbook cover these points: Theory of electrical discharge machining, applications, equipment, service, and electron drills used for salvaging broken tools from workpieces. Briefly stated, the book gives the user or potential user of this machining technique a thorough background of information on the subject. Actual uses for electrical discharge machining are described and compared thoroughly with methods previously used by present Elox users. The application section is a real help for those deciding how and where they can benefit by using electrical discharge machining methods.

SHEET AND PLATE PRODUCTION INFORMATION, Second Edition. Published by Technical Publications Department, Kaiser Aluminum & Chemical Sales, Inc., Chicago 11, Ill., 1958. 350 pages, free if requested on company letterhead, otherwise $5.

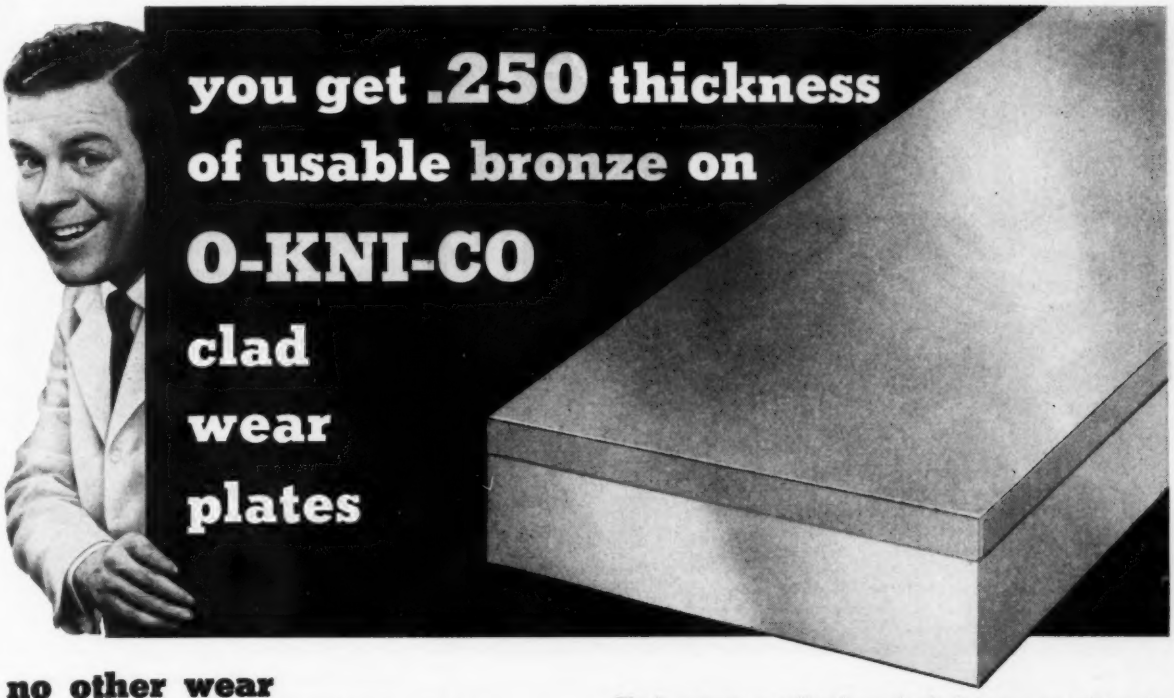
The purpose of this book is twofold: To describe aluminum and its alloys as a metal, how it is made, its availability, and its physical and chemical attributes; and to concisely report basic facts which will be helpful in the proper selection and use of aluminum sheet and plate alloys. This is done.

Editorial treatment of each subject is in sufficient detail to enable the reader to understand and effectively apply data. Tables show aluminum characteristics needed to select the best suited alloys for various manufacturing processes. Alloys are evaluated as to such characteristics as formability, machinability, and weldability. Streamlined information on forming and bending and machining is included, while more comprehensive treatment is given to joining and fastening aluminum.

NECROLOGY

Joseph Brodner, Sr., former part owner of the Damen Tool & Engineering Co., Chicago, died in May.

Alexander S. Keller, 53, vice president and general sales manager of Pratt & Whitney Co., died May 15 at Hartford (Conn.) Hospital.



no other wear plates now offer this tremendous advantage

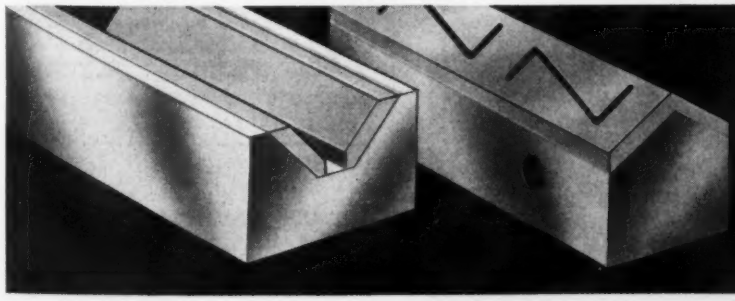
O-KNI-CO clad aluminum bronze wear plates are a combination of ¼" thick aluminum bronze eternally clad to a tough, easily machinable steel backing. Unlike ordinary thinly coated products, O-KNI-CO clad aluminum bronze wear plates deliver phenomenally long wear. Their steel backing gives great strength. You receive them completely finished, ready to install. Available in 14 standard cross sections from ½" to 1¼" thickness, 1½" to 8" width, up to 72" length. Special sizes furnished to your requirements. Drilling and counter-boring can be done through bronze if required.

Their many applications include use as slides in cam and trim dies, or wherever there is a sliding action between flat metal parts. Hundreds of machine tool builders and users are enjoying the many advantages of O-KNI-CO aluminum bronze wear plates. If you are contemplating using bronze wear plates it will pay you to consider the many, many dollars you will save in replacement costs alone when you purchase long wearing O-KNI-CO .250 thick bronze wear plates. If you are now a user of solid bronze wear plates, O-KNI-CO offers you approximately 40% savings in initial cost alone and delivers the same performance. Immediate delivery available on standard sizes. Data Sheets illustrating applications are available by writing Dept. LL.

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES
SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS



Also in wide usage are O-KNI-CO Clad Aluminum Bronze Ways and Gibs. Ideally suited to run against O-KNI-CO Hardened Ways.

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Lepel

HIGH FREQUENCY INDUCTION HEATING UNITS

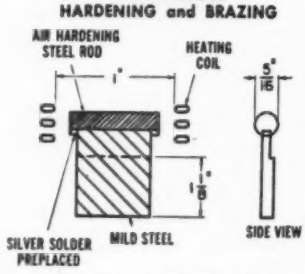
BRAZING
HARDENING
SOLDERING
ANNEALING
BOMBARDING
MELTING

The Lepel Line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

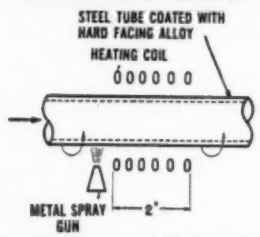
TYPICAL INDUCTION HEATING APPLICATIONS

SIMULTANEOUS HARDENING and BRAZING

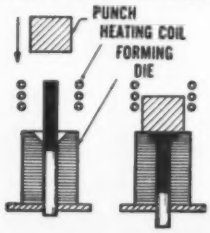


The machined and finished rod of air-hardening steel is simultaneously hardened and brazed to a mild-steel tab. Use of a purified hydrogen atmosphere and a high temperature brazing alloy permits successful hardening of alloy steels without discoloration and scaling even in the absence of flux.

DIFFUSION BONDING OF SPRAYED METAL COATINGS



Corrosion or wear resistant metal coatings sprayed on metal surfaces can be improved by heating to achieve alloying by diffusion. The drawing shows a typical arrangement for processing steel tube sprayed with hard facing alloy. Long tubes may be progressively sprayed and heated.



HEATING HIGH STRENGTH ALLOYS FOR FORMING

Uniform and rapid heating of high strength alloys (alloy steels, titanium, etc.) aids in upsetting and forming operations and also minimizes oxidation and embrittlement.

Electronic Tube Generators from 1 kw to 100 kw
Spark Gap Converters from 2 kw to 30 kw

WRITE FOR THE NEW LEPEL CATALOG ... 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE NFORM-A-GRAM KEY NO. 70

"Commendable Comments"

"We progress as individuals, as companies, and as a nation when we produce more useful goods and services per hour of human effort. In the atmosphere of our American competitive way of industrial life there will be and must be a continuing trend to increase the over-all productivity of our private enterprise system. . . . And, may I add, goods produced with the proper degree of reliability. . . . To have reliability the things we make must work: do the job for which they were intended. No one today can long be part of an organization that furnishes goods and services which do not satisfy the customer—the one who pays the bill—you and I and our families. We simply cannot afford to make or buy troublesome products any longer."

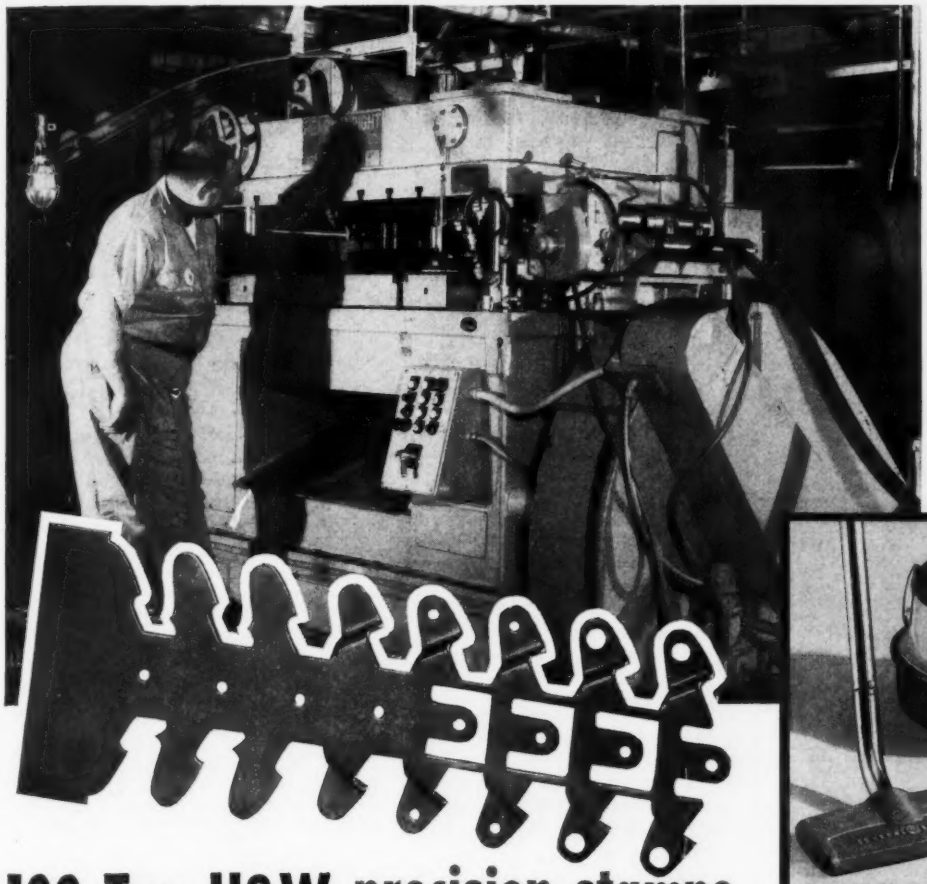
—H. Thomas Hallowell, Jr., president Standard Pressed Steel Co., addressing 26th annual meeting of American Society of Tool Engineers, in Philadelphia.

"Far from throwing men out of work, automation is our main hope today in some industrial areas for keeping men employed at high wages. Without the use of cost-cutting automation we have little hope of controlling or lowering final costs to a point where more people can buy the products we make. Correctly applied, automation enables us to absorb the cost of our vastly increased production capacity without reducing wages. In the final analysis, the cost of anything we make depends on just three things—the cost of wages, the cost of the tools (automation) the wage earner uses, and the cost of materials. When these three factors are brought into proper balance, maximum efficiency is realized from our productive capacity. . . . The automatic factory is economically impossible today. . . . It's quite possible that there will always be something which you can do more economically using human rather than machine effort."

—Chester S. Johns, executive of Buhr Machine Tool Company, speaking to members of Hamilton, Ohio Industrial Management Club.

BUY U.S. SAVINGS BONDS TODAY!

Another H-P-M Henry & Wright . . . in service at General Electric



Another 100-ton Henry & Wright double crank dieing machine stamps floor tool brackets for model C-6 General Electric vacuum cleaner at Housewares and Radio Receiver Division, Cleveland, Ohio.

100-Ton H&W precision-stamps GENERAL ELECTRIC Vacuum Cleaner Part on 7 stage die

The precision, speed and flexibility with which the double crank H & W handles both the simple and complex progressive stamping jobs make it an integral part of the automation processes in many large companies such as General Electric. Its versatility greatly extends the range of work that can be handled.

The advantages of the double crank system include high speed operation with perfect alignment, even with severe off-center loads, and longer die life made possible by a pulling rather than a pushing stroke on the die. You can form larger parts on the lower capacity machines, or produce stampings requiring high pressures with precision. The machine has a low center of gravity, giving it greater rigidity and strength. Sizes from 25 to 500-tons meet your every need.

Assure yourself of top quality work and proven production economies with H & W dieing machines. Call or write your H-P-M representative today for complete information. You'll be glad you did!

H837

THE HYDRAULIC PRESS MFG. COMPANY

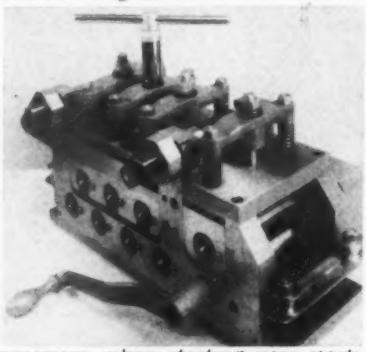
A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

CIRCLE INFORM-A-GRAM KEY NO. 71

PRODUCTS on PARADE

For more information about the products described here, use POSTAGE-FREE Reader Service Card in this issue.

A Heavy-Duty Stock Straightener takes light or heavy stock up to ¼" thick and 4" wide and may be adapted to special widths up to 10". No resetting of individual rolls is



necessary when starting new stock coils. The top rolls are released and replaced by a turn of a crank. Durant Tool Co., Providence, R. I., or—**Circle Inform-A-Gram No. A1.**

Wide Working Range, large drilling and tapping capacity, and quick, easy handling are features of the radial drill announced by Cosa Corp., 405 Lexington Ave., New York 17.

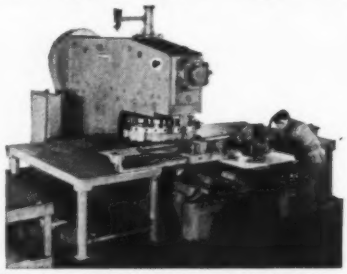
The Donau DB 25 has a drilling capacity of 1" in solid steel and tapping power of ⅞" in steel. Get more data from the company, or—**No. A2.**

A Hydraulic Bending Machine has power for bending steel bar stock or other material up to 3/16" x 2". Rating is to 7000 lb at the bending tools

and maximum opening is 4". 26 dies are supplied with the Model 6 machine. For information, write J. A. Richards Co., 903-05-07 N. Pitcher St., Kalamazoo, Mich., or —

Circle Inform-A-Gram No. A3.

Using a New Optical Positioning System, holes are accurately and rapidly located to a non-dimensional full-size drawing and parts pierced with the 80-ton RA-101 Wiedemann turret punch press. Engineering



time is minimized since detailed shop drawings are not required. Hole-to-hole and edge-to-hole dimensions are eliminated. Only outside dimensions of the part are required. Wiedemann Machine Co., 781 Gulph Rd., King of Prussia, Pa., or — **Circle No. A4.**

A Portable Computer, designed for evaluating existing metal cutting conditions or for establishing machining practices on new operations, has been developed by

Kennametal Inc., Latrobe, Pa. Cutmeter puts into convenient form the relationships of feed, speed, depth of cut, and power which have been established through metal cutting research. Practical feeds and speeds for starting a job are "dialed" with it. The 8-lb computer comes in a plastic case. Write to the company for information, or —

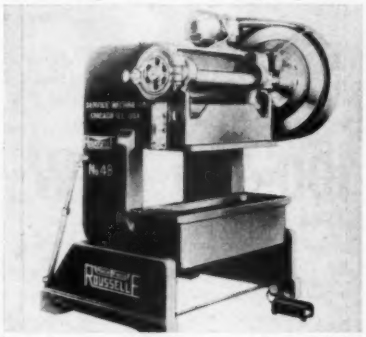
Circle Inform-A-Gram No. A5.

Apply Layout Fluid or other fluids easily with the Dykem FB-57 fountain brush with the non-breakable bottle. No re-dipping is necessary,

because by squeezing the bulb, liquid flows to the end of the brush. For more information, write The Dykem Co., 2307 N. 11th St., St. Louis 6, or —

Circle Inform-A-Gram No. A6.

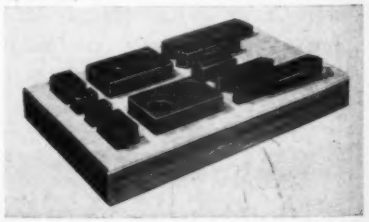
A 40-Ton Double-Crank OBI Punch Press features extra large 12" die area and electrically-controlled, air-operated friction clutch. Rouselle 4B is adaptable for multiple punch-

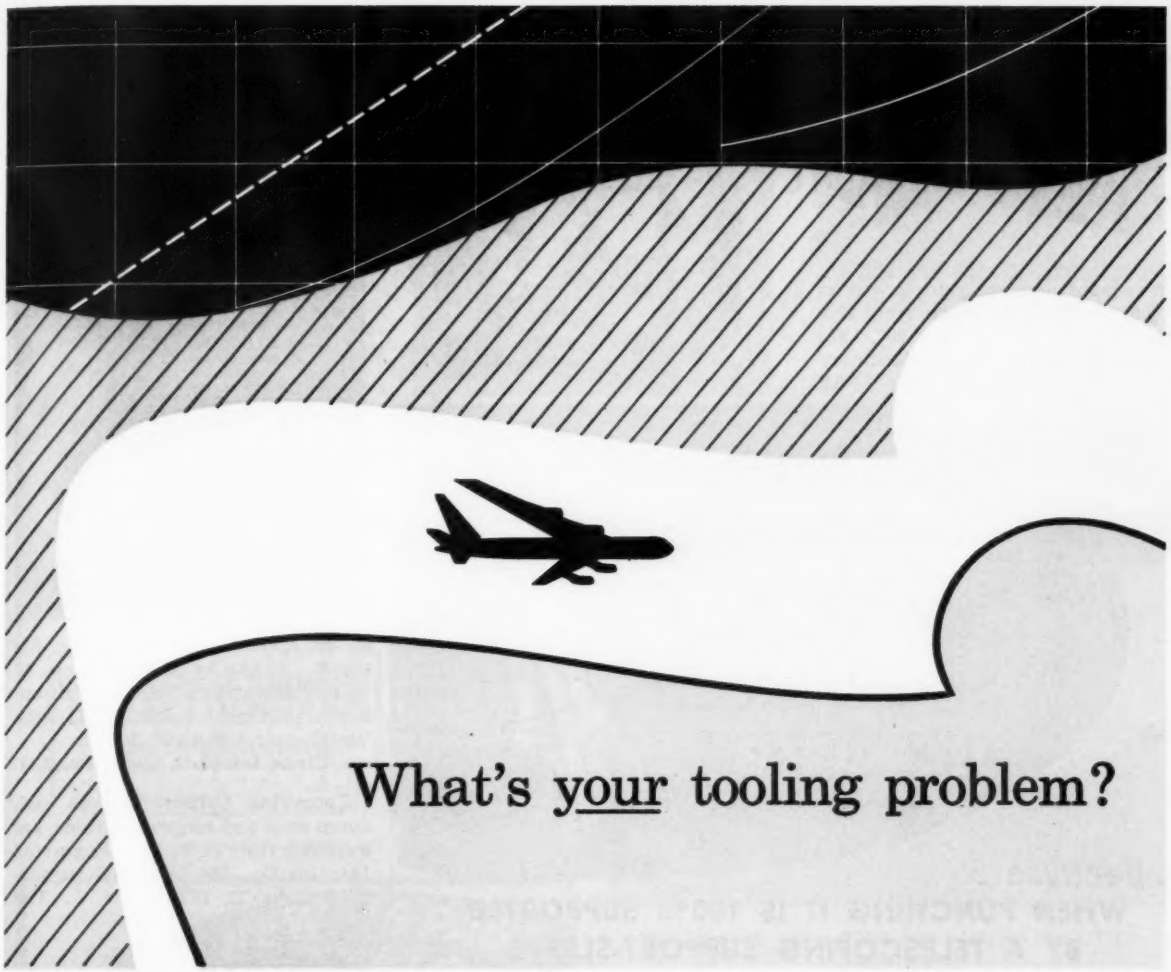


ing, large workpieces, and multiple operations, as well as regular operations. Service Machine Co., 2310 W. 78 St., Chicago 20, or —

Circle Inform-A-Gram No. A7.

Step Block and Clamp Sets have been added to Northwestern's line of hold down and clamping tools. Standard, heavy-duty and double-duty sets are available with blocks 1", 1½", and 2" wide, respectively. For information, write Northwestern Tools, Inc., 116 Hollier Ave., Dayton 3, Ohio, or — **Circle No. A8.**





Your tooling resin formulator can help you with EPON® RESIN

The skill and knowledge of your tooling resin formulator combined with Shell Chemical's years of experience and technical research mean more profitable production for *you* with Epon resin tooling.

In addition to supplying basic tooling information, Shell Chemical also has developed extensive data on fillers, flexibilizers, curing agents, and diluents for your tooling resin formulator.

In many fields of industry, the unusual physical properties of tools made with Epon resin-based formulations make possible the saving of more than half the cost of fabricating a conventional tool.

High temperature tooling. Both metal and plastic forming tools, capable of operating at temperatures between 400°F. and 500°F., can be made with Epon 1310.

Long-lasting metal forming tools. Test results show that a casting of an Epon resin formulation mounted in a crank press and subjected to repeated blows had no permanent deformation after 28,000 cycles.

Excellent tolerances. Little machining and handwork are required to finish Epon resin tools, because the material can be fabricated to very close tolerances.

Outstanding strength. Tools with thin cross sections can be laminated with layers of glass cloth and Epon resin to achieve high flexural strength.

Can Epon resin help you with your tooling? Find out now by writing your tooling resin formulator. For a list of tooling resin formulators, write to Shell Chemical.

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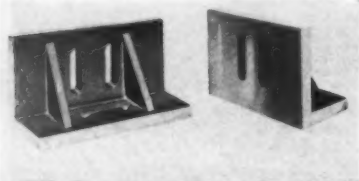
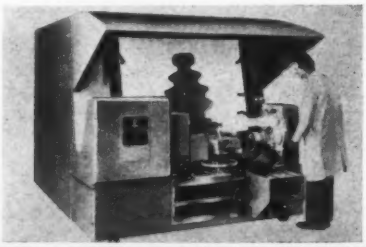
CIRCLE INFORM-A-GRAM KEY NO. 73

A Slotted Angle Plate provides slotted bolt holes on both sides so work can be clamped to the plate and the plate to the machine bed. They



are square and accurate to within 0.0005" in 6". Sizes range from 4" x 5½" x 5" to 16" x 18" x 20". For data, write The Challenge Machinery Co., Grand Haven, Mich., or — **A9.**

A Large Optical Projector with 60" x 40" transparent screen inspects parts covering a field of 6" at a magnification of 10x. The WP100 is designed for inspection of contours such as templates, gears, cam forms,

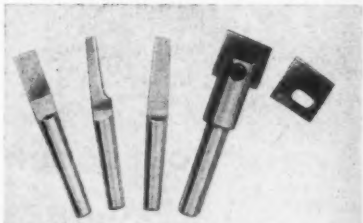


and screw threads, and for visual finishing of profile gages while shown on the screen. Optical Gaging Products, Inc., 26 Forbes St., Rochester, N. Y., or — **Circle No. A10.**

An Improved 7" Stroke Precision Bench Shaper has an automatic pressure lubrication system for smooth operation at high speeds. Adjustable oil pressure can be maintained

at all speeds, thus cushioning the shock. Stroke rates range from 42 to 195/min and cutting speeds from 3' to 114' sfpm. South Bend Lathe Works, South Bend 22, Ind., or — **Circle Inform-A-Gram No. A11.**

Engraving Cutters, in both high speed steel and tungsten carbide, are available from H. P. Preis Engraving Machine Co., 284 Industrial Branch, U. S. Hwy 22, Hillside, N. J. The



steel taper shank cutters come in four styles without flange and wrench flats. Single- and double-edged tungsten cutters are also available. **Circle Inform-A-Gram No. A12.**

Positive Rake Toolholders are made in styles for holding triangular inserts or square inserts and in shank sizes for use in conventional tool

posts and open side tool posts. Each style is available in a range of sizes. Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago 46, or — **Circle Inform-A-Gram No. A13.**

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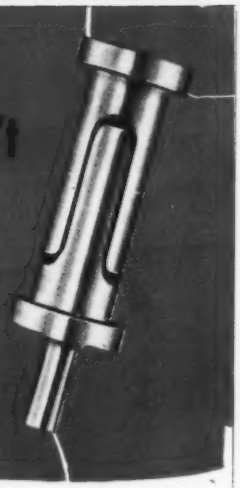
A Durable Perforator Can't KNUCKLE... BUCKLE... OR BEND...



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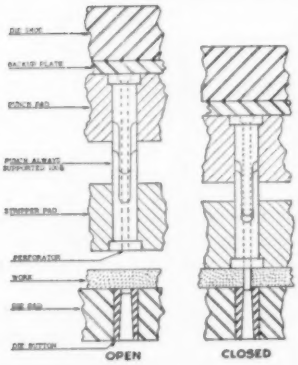

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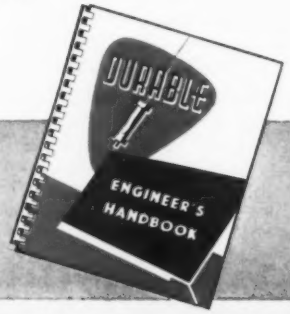

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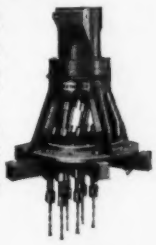

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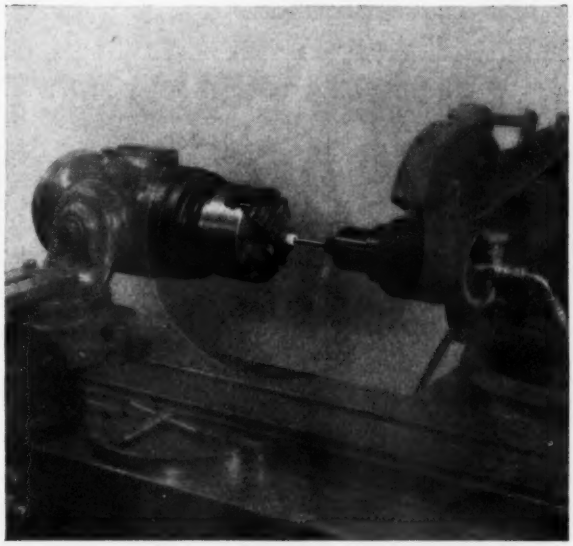

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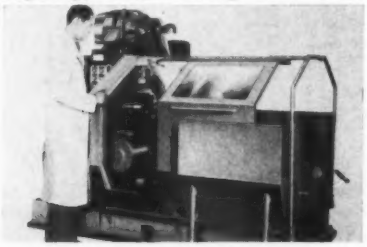
VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 753

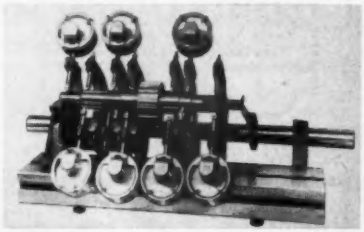
High-Speed Production of hard-to-machine alloy components is the principal use of new Model 3E-15 automatic turret lathe. The small heavy-duty machine has a 10" chuck capacity, 11½" swing over base ways, and handles a variety of small to medium size work. Potter & Johnston Co., Pawtucket, R. I., or — **Circle Inform-A-Gram No. A14.**



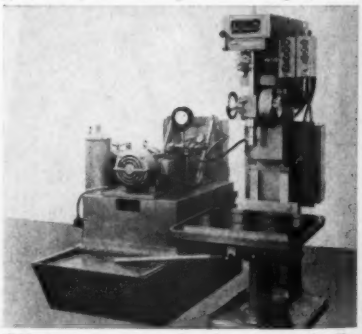
Compact Micro-Fog Lubrication Units are contained in splash-proof cabinets that lock. One- or two-qt oil capacities and a choice of 32, 200, or 300 rated bearing inch capacities are available. An air filter automatically removes liquids and solids from the air supply. C. A. Norgren Co., Englewood, Colo., or — **Circle Inform-A-Gram No. A15.**

A Small General Purpose Milling Machine, No. 1D, for toolroom or production operations has available a full 1½ hp at the spindle allowing heavier cuts to be taken, and a No. 40 taper spindle nose allowing increased cutter range and versatility. The Cincinnati Milling Machine Co., Cincinnati 9. **Circle Inform-A-Gram No. A16.**

Take Several Measurements on one component using the Combination-Chek No. 5000 which can be used with other standard parts to make fixtures for measuring diameter, lengths, spaces, etc. Principal application is for checking turned and ground circular components; 0.200" to 2¾" dia and 20" lengths can be handled. C. E. Johansson Gage Co., Dearborn, Mich. **No. A17.**



Use a High Pressure Coolant System with carbide-tipped gundrills. The 140-gal capacity Model 2HPC comes with 5-hp motor delivering 10 gal/min, or 10-hp for 20 gal/min. Oil temperature is thermostatically regulated, and an alarm system indicates low supply. Edlund Machinery Co., 50 Huntington St., Cortland, N. Y., or — **Circle No. A18.**



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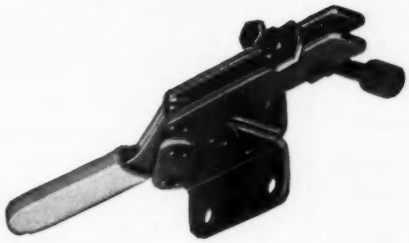

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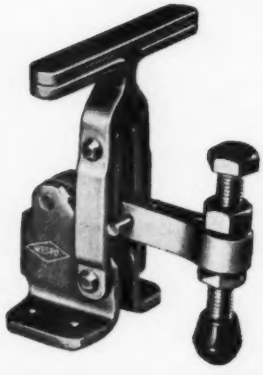
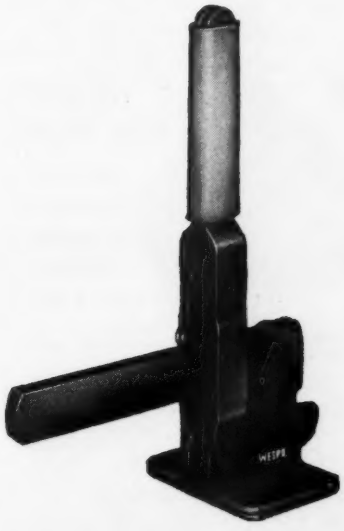
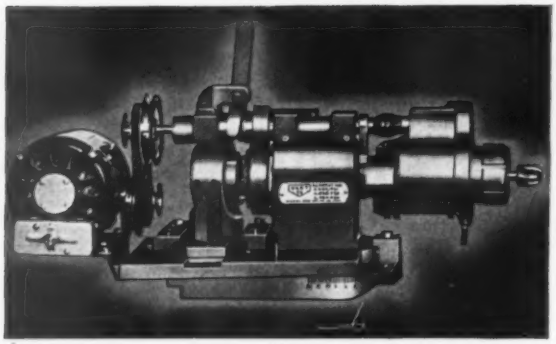
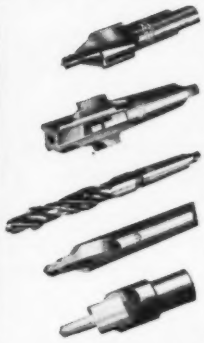




Precision CIRCULARITY GRINDING ATTACHMENT





Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, a combination of form and radial relief, tapered cylindrical and straight cylindrical.

Model 500 Circularity Grinding Attachment is faster—easier to handle—has positive control—greater adaptability—rugged construction—is engineered and built to provide the finest precision work.

You Can Grind Tools Like These On A DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT

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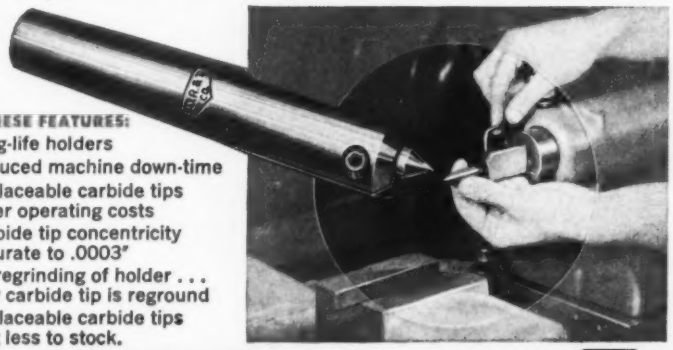

CHECK THESE FEATURES:

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2. Reduced machine down-time
3. Replaceable carbide tips lower operating costs
4. Carbide tip concentricity accurate to .0003"
5. No regrinding of holder . . . only carbide tip is reground
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1806	5"	6¼"	195.00
1810	10"	5"	265.00

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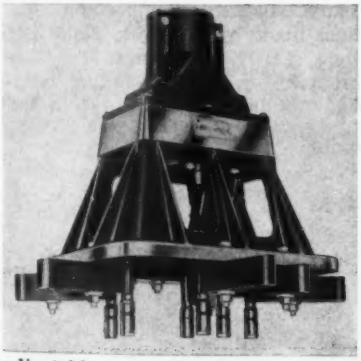
A Press Feed Arrangement hitch-feeds material at 200 to 2500 ipm, with accuracy to ±0.002". Feed strokes up to 36" are possible with Flexofeed, used in conjunction with a Flexopress, which handles conventional dies. Precision Welder & Flexopress Corp., 3520 Ibsen, Cincinnati, or — **Circle No. A19.**

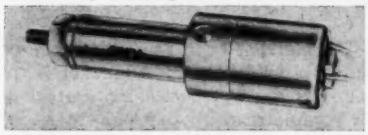
Vertical and Horizontal Tapping is possible with the Model 25-20 machine announced by Kaufman Mfg. Co., Manitowac, Wis. It has ¾" capacity, and has tapping speeds from 190 to 1200 rpm. The reversing type head has a 2½" lead screw stroke. **No. A20.**

A Nozzle Guard is now furnished with all Trico-Mist coolant systems. It protects the nozzle tip if it touches rotating tools. Port holes in the guard create an air mixing chamber to eliminate condensation, course mist, or dripping. Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, or—**Circle Inform-A-Gram No. A21.**

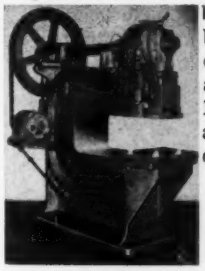
Fifteen Gear-Driven Spindles for multiple drilling and tapping can be used with the new Model 8-12 Multi-Drill. Locating arms are universally adjustable over the 25½" x 21½" area. Multi-Drill fits any drill press and has a capacity of ½" steel and ¾" cast iron. Get data from Commander Mfg. Co., 4225 W. Kinzie St., Chicago, or — **Circle No. A22.**



A "Throw-Away" Stainless Steel Bodied Air Cylinder with built-in electric solenoid valve, is announced by Bimba Hardware & Mfg. Co., 103 Main St., Monee, Ill. The valve is designed for continuous operation and is ideal for small spaces. Maximum operating pressure is 150 psi. For data, write the company. **Circle Inform-A-Gram No. A23.**

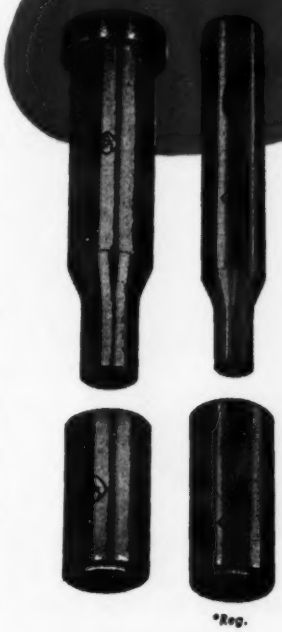


A 45-Ton Heavy-Duty Deep-Throat Press with end flywheel has a 36" depth of throat, 4" dia shaft at pin bearing, 24" x 16" bed area, 14" open height, and alloy cast frame. Model 15M is available in plain or geared models. **Circle No. A24.**



If your feeling the PINCH...

For want of a PUNCH...



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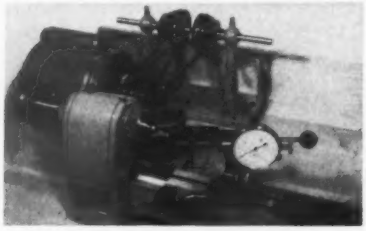
CIRCLE INFORM-A-GRAM KEY NO. 79

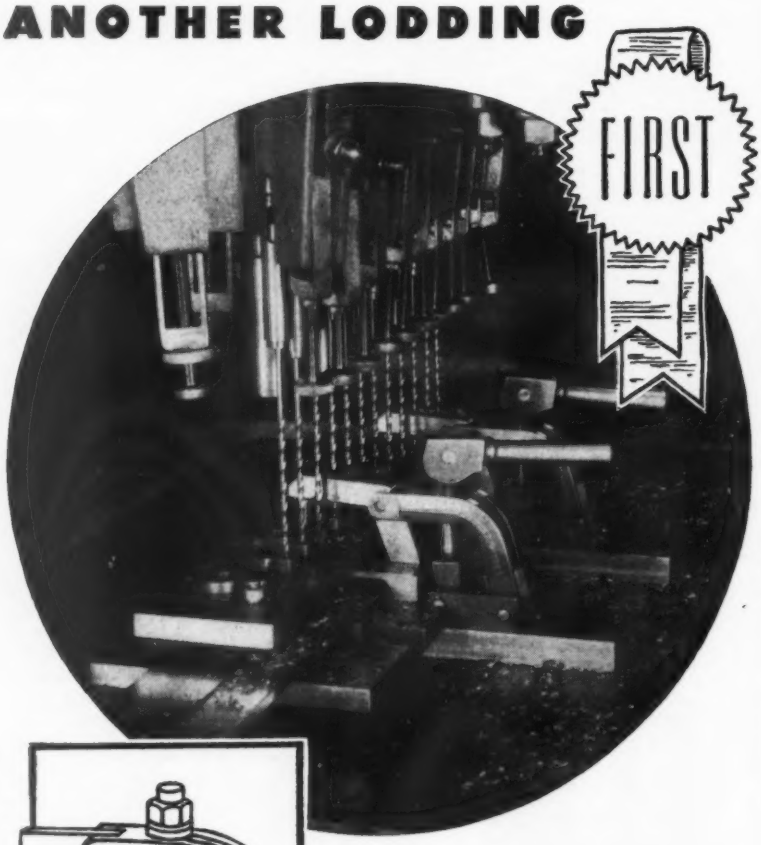
Use a Radius Turning Attachment to turn concave and convex radii. With the Model A lathe, which has a ½" capacity through the headstock, a piece can be taken and turned to any radius that is needed. By using a step chuck a radius of up to ¾" dia can be turned. For information, write F. W. Derbyshire, Inc., Waltham 54, Mass., or —

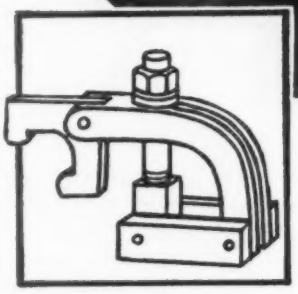
Circle Inform-A-Gram No. A25.



A Metal Finishing Process produces a bright, lustrous finish on high alloy steels. The Cor-A-Brite process is completed with one chip mass in one standard barrel finishing machine, eliminating handling of parts. Bearings and stampings can be finished. Roto-Finish Co., Kalamazoo, Mich., or — **Circle No. A26.**

ANOTHER LODDING





Lodding Double-Acting Retracting Clamp — clamps in two directions simultaneously. Comes in 4 sizes each of 3 types — hand knob, nut and hand cam.

Now ready for you at your nearest Lodding distributor

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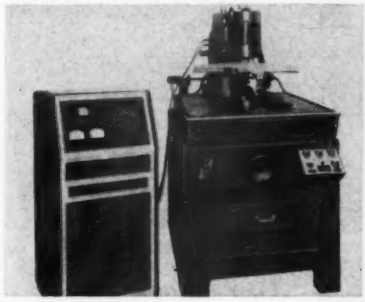
Ambassador 2-2273

CIRCLE INFORM-A-GRAM KEY NO. 80

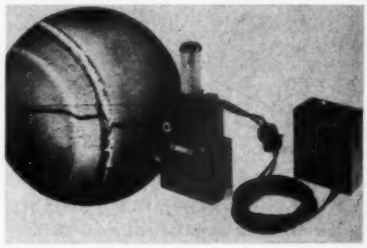
Measure Waviness on symmetrical surfaces of rotation up to 18" dia using the vertical Wavometer. It shows the effects of a finishing process on waviness, gives audible evidence of irregularities, and is good



for measuring work in the inspection or production departments. For information, write Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich., or —

Circle Inform-A-Gram No. A27.

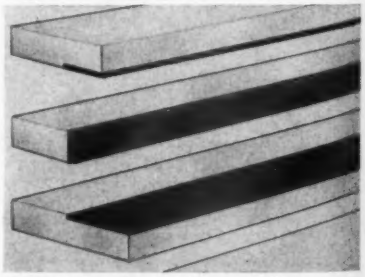
Accurate Measurements of Scratches and Pitted Areas on the outside surface of metallic sheet and tube can be obtained with a new optical instrument. This scratch



depth indicator can also measure the thickness of paint and the flushness of abutting surfaces. Calibrations are to 0.0001". Boeing Airplane Co., Seattle 24, Wash., or —

Circle Inform-A-Gram No. A28.

Solve Any Die Building Problem using standard composition sections made by The Ohio Knife Co., Dept. LL-77, Cincinnati 23. They are used for cut-off, blanking, forming, and flanging and also draw and



pinch trim dies. These sections, specially hardened tool steel bonded to a soft steel backing, are available in 17 styles and in lengths up to 125".

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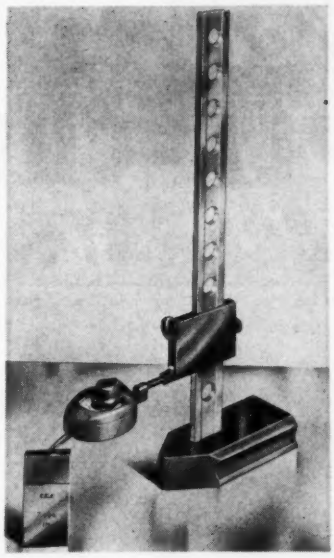

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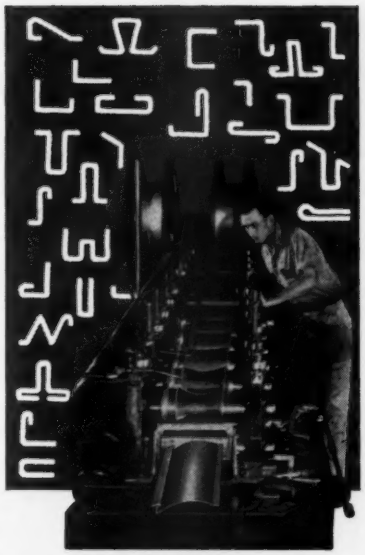

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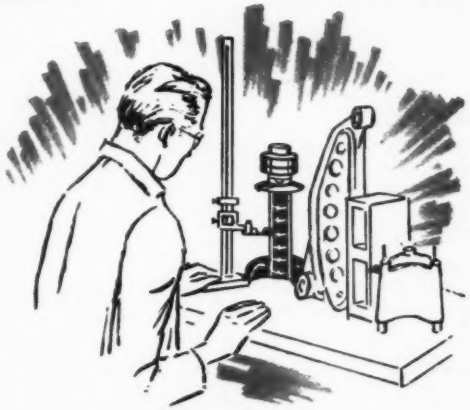

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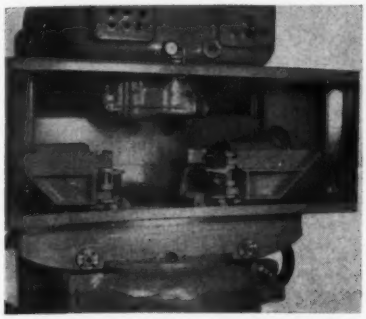
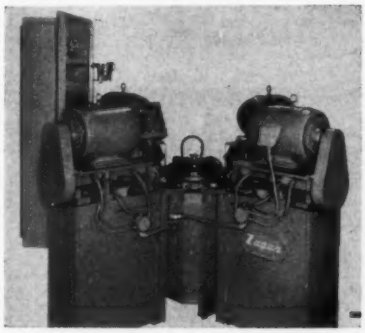


and tailstock centers, and the elimination of skidding of the gear shaft bearing or arbor surfaces are possible with this design. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, or —

Circle Inform-A-Gram No. A30.

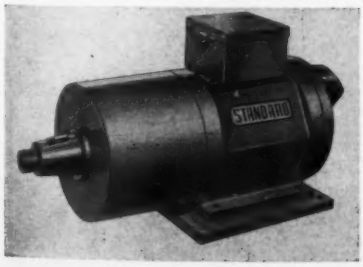
A Small, Compact Machine to process precision parts has been announced by Zagar Inc., 23894 Lakeland Blvd., Cleveland 23. The part can be drilled, countersunk, and



reamed from four sides simultaneously. Drilling capacity is up to 1¼" dia and rated production is 80 pcs/hr. Because the demountable feed units have a 10" stroke, other operations can be performed.

Circle Inform-A-Gram No. A31.

Super Precision Spindles, motorized or independent drive, are now available to handle 1000 amps. Illustrated is a 5 hp, 1800/3600 rpm



model with slip ring and isolation for 1000 amps, and suitable for 3000 amps in the process of electrolytic metal removal. The spindle nose will serve a variety of wheel holders for straight or recessed wheels. The Standard Electrical Tool Co., Mt. Hope & 6th Sts., Cincinnati 4, or —

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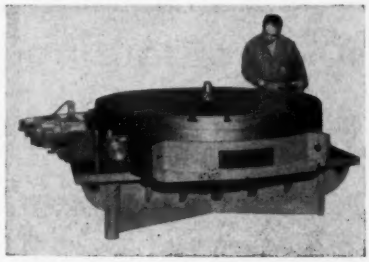
Universal, Automatic Rotary Indexing Machines are available in table diameters up to 84" for general production work. Suitable for heavy drilling, milling, boring, and inspection, or for programming, tracing, and broaching, the Rotomatic positioner is said to accommodate loads up to 50,000 lbs. For information write the Lapointe Machine Tool Co., Hudson, Mass., or — **Circle No. A33.**



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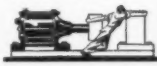

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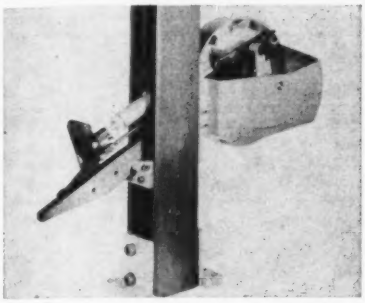

feed and speed requirements. Model FE-2 handles parts up to 2" OD, and a maximum of 180 pcs/min. Dixon Automatic Tool, Inc., 2300 23 Ave., Rockford, Ill., or — **Circle No. A34.**

A 110-Ton Welded Steel Frame Box Slide Press has a self-cooling diaphragm-type combination brake and clutch. Sintered metal friction surface plates assure long life. V & O Press Div'n, Emhart Mfg. Co., Hudson, N. Y.

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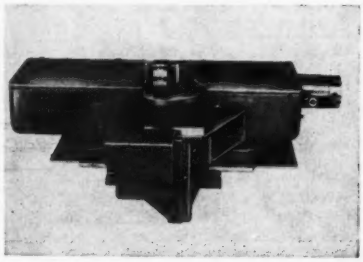

across the wheel, producing a perfect blend of all radii and tangents. Hoglund Engineering & Mfg. Co., 343 Snyder Ave., Berkeley Hts., N. J., or

Circle Inform-A-Gram No. A36.

Use a Multi-Service Grease for a number of jobs. Mobilplex EP is a calcium-EP-complex grease which withstands extreme pressures, has long service life, is water-resistant, and protects against rust and corrosion. Industrial Lubricating Dept., Socony Mobil Oil Co., Inc., 150 E. 42nd St., New York 17, or —

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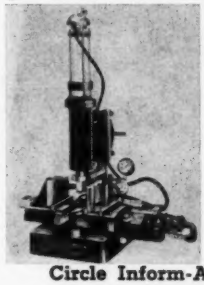

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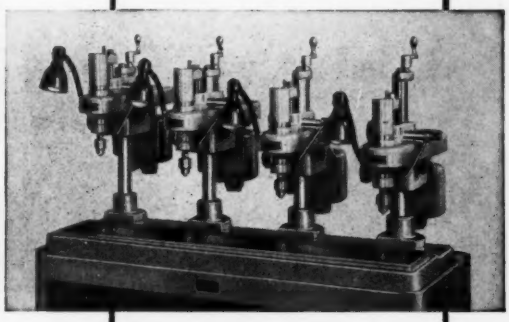

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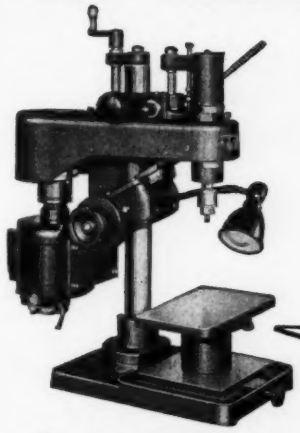

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Circle Inform-A-Gram No. A40.

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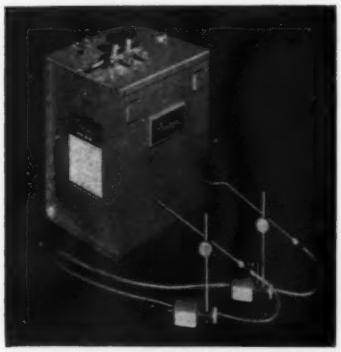

is used for all machining, tapping, drilling, grinding, and metal drawing operations. For information, write Precise Products Corp., Racine, Wis., or—**Circle Inform-A-Gram No. A41.**

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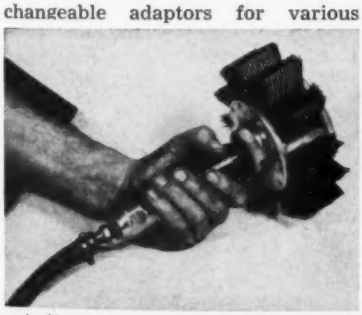

spindle sizes or male stud for chuck mounting. Grinding & Polishing Machinery Corp., 2530 Winthrop Ave., Indianapolis 5, or —

Circle Inform-A-Gram No. A42.

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Circle Inform-A-Gram No. A43.

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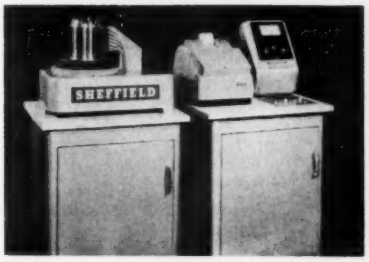
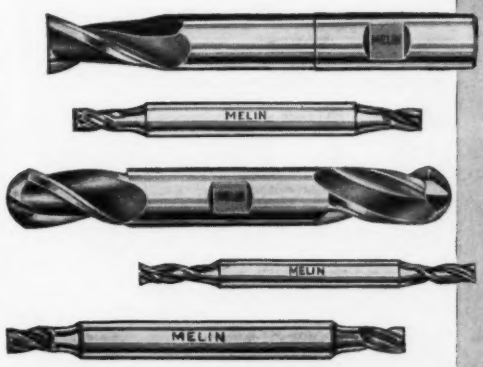
Circle Inform-A-Gram No. A44.





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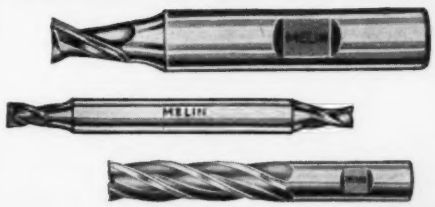

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CIRCLE INFORM-A-GRAM KEY NO. 87

A 3' Radial Drill has quick-action clutching which speeds drill operation, and the positive jaw-type clutch can never slip. A push-button drill ejector in the spindle speeds tool changes while arm is raised and lowered. 16 spindle speeds are available from Veet Industries, 25753 Groesbeck Hwy., E. Detroit, Mich., or—**Circle Inform-A-Gram No. A45.**

A 3-Ton Progressive Bending Press features a 10-position indexing turret with adjustable stops which automatically selects proper angle for each bend. It handles up to 1" OD, 14 gauge steel tubing, and produces about 1,000 to 1,500 bends/hr. Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill.

Circle Inform-A-Gram No. A46.

Now! THE ALL-NEW DPS MODEL U (Universal) POWER SCREWDRIVER

WITH BRAND NEW FEATURES AND ADVANTAGES NEVER BEFORE AVAILABLE

NEW TYPE POSITIVE CONTROL CLUTCH

- Not affected by changes in temperature or excessive oil or grease
- Sharply increased accuracy as to variation in torque tolerance
- Simplified design for easy servicing
- Requires no daily lubrication
- No friction devices of any kind used
- Long service life on all parts subject to wear

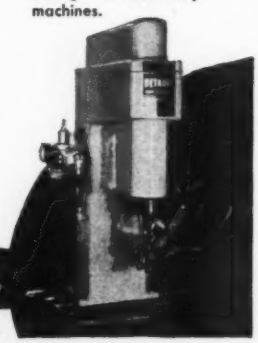
NEW TYPE HOPPER DRIVING MECHANISM

- No gears to wear out
- No lubrication required
- No costly replacement parts
- Simple design for easy servicing
- Built-in slip control as a safety feature

Also furnished as a completely *Self-Contained Driving Head* for use in specially designed assembly machines.

NEW TYPE FEED TRACK AND ESCAPEMENT MECHANISM

- Flexibility for easy and fast adjustment
- Escapement does not require daily lubrication
- Escapement design permits releasing screws by body or head as required
- Positive solenoid action
- Simple design for easy servicing
- Adjustable for full capacity of machine



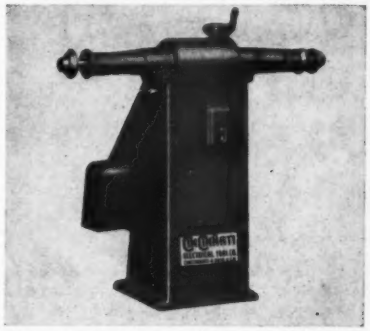
Write for NEW Brochure!

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT ST. DETROIT 16, MICH.

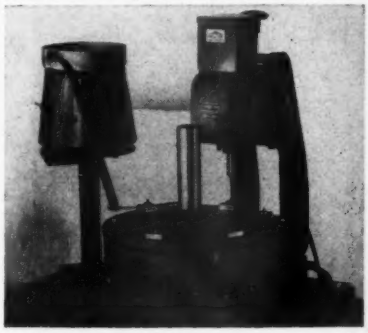
CIRCLE INFORM-A-GRAM KEY NO. 88

Maintaining Peripheral Speed throughout wheel life is possible on the new buffers and polishers with variable speed range of 1500 rpm to 3000 rpm. Instant spindle speed



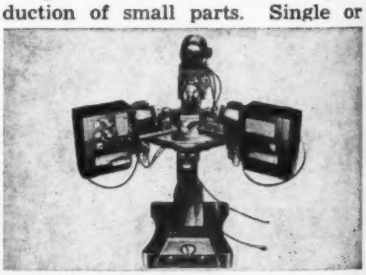
changes through a hand-wheel provide correct surface speed for buffing, polishing, and wire brushing. For information, write The Cincinnati Electrical Tool Co., 360 Mt. Hope Ave., Cincinnati 4, or — **No. A47.**

Stake Shading Rings in solenoid armatures with a semi-automatic machine. Designed to speed the assembly of solenoid-operated valves, it can be adapted to jobs where con-



trolled impact is desired. The punch it rated at 10,000 lbs of impact and estimated production is 48 to 50 pcs/min. Black & Webster, Inc., Newton, Mass., or — **Circle No. A48.**

A Circular Production Table Assembly has mounting space for up to six power tools for automatic production of small parts. Single or



multiple drilling, tapping, facing, chamfering, etc. for short or long runs can be set up on it. The Dumore Co., 1300 17th St., Racine, Wis., or—**Circle Inform-A-Gram No. A49.**

SPECIFY TOP QUALITY

DE-STA-CO

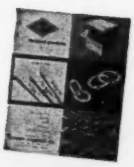
ARBOR SPACERS SHIMS and SPACING COLLARS • Arbor Spacers and Shims in 20 sizes and thicknesses from .001" to .125". Arbor Spacers furnished with standard keyway; Shims, with no keyway. Also Spacing Collars in numerous popular diameters, and in thicknesses from ⅛" to 3". Hardened and ground; edges chamfered. Furnished with standard keyway.

FEELER STOCK • Made from tempered stock, rolled to close tolerances, ½" x 25' coils packaged in transparent plastic boxes, except above .020". Strips ½" x 12", in cellophane. 27 thicknesses. All thicknesses from .001" to .032". (For use in precision fitting, checking clearances, inspection and production work.)

SHIM STOCK • Steel or brass. Selected from material rolled to precision limits, free from burrs, and protected by oil coating. Coils packed in carton for easy dispensing and protection. 15 thicknesses, .001" to .032". Sheets 6" x 12"; coils 6" x 120". Available also in two assortment packages —12 thicknesses, .001" to .015", and 15 thicknesses, .001" to .032".

DE-STA-CO

WRITE FOR Illustrated Brochure and Price List!

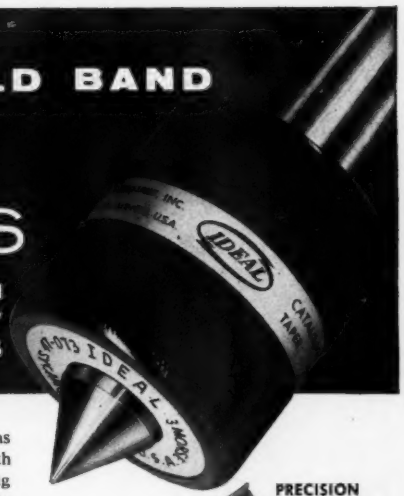


DETROIT STAMPING CO.
344 Midland Ave. Detroit 3, Mich.

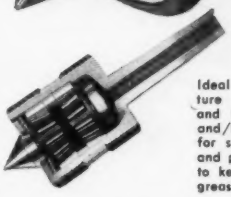
CIRCLE INFORM-A-GRAM KEY NO. 891

IDEAL GOLD BAND LIVE CENTERS

GUARANTEED TO MATCH OR EXCEED, "CRITICAL" JOB SPECIFICATIONS



In the GOLD BAND line Ideal has combined the latest production methods with their traditionally fine craftsmanship to bring you an unequalled standard of excellence in live centers. Accurate, (to ± .0001") GOLD BAND Live Centers offer "custom" quality at production prices. Specify GOLD BAND Live Centers and your every need can be accommodated from stock . . . 99 times out of 100. Ideal's GOLD BAND Live Centers offer savings, simplified operations and higher lathe output both in quantity and quality. Contact your distributor today...or



PRECISION FITTED BEARINGS

Ideal Live Centers feature precision machined and hardened ball and/or roller bearings for superior accuracy and performance. Sealed to keep dirt out, grease in.

A COMPLETE LINE FOR EVERY NEED...SPECIALS, TOO!

Send for Complete catalog data and specifications.

IDEAL **IDEAL INDUSTRIES, Inc.**
1134G Park Ave., Sycamore, Ill.

DISTRIBUTED BY THE NATION'S LEADING INDUSTRIAL DISTRIBUTORS

CIRCLE INFORM-A-GRAM KEY NO. 892

most VERSATILE PIN GAGES *made!*

Horberg exclusive taper feature lets you check undersize, oversize and odd-size holes, slots, etc., quickly and accurately with standard letter, number or drill-size gages.

A precision concentric taper on the lower half of each gage runs to 0.0012" smaller than gage size. You get a continuously accurate range of measurement with each gage, for quicker, handier, precision gaging in set-up, machining, tooling and inspection operations.

SPECIFICATIONS

Diameter accurate to +0.0001" —0.0000"
Standard 1.3" length
Concentric taper on lower half to .0012" smaller size
Oil hardened tool steel

PRICES AND ORDER FORM (F.O.B. Bridgeport, Conn.)

_____Letter sets—52 gages A-Z in pairs $65.00
_____Fraction sets—60 gages 3/64" to 1/2" in pairs $75.00
_____Number sets—120 gages 1-60 in pairs $130.00
_____Single gages_____size ea. $1.50

Sets furnished in indexed plastic case. Extra case $15.00
Prices subject to change without notice.

Please rush items checked to:

Name_____
Company_____
Address_____

Horberg GAGE COMPANY 29 Staples St., Bridgeport, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 893

YOUR ▼ TRADE MARK

ON A PRODUCT INDICATES YOUR PRIDE IN PRODUCTION

Yours is a quality product, and it deserves the *best* in identification. *Show* your pride in it by marking it with distinction.

If It's Worth Making, It's Worth Marking.

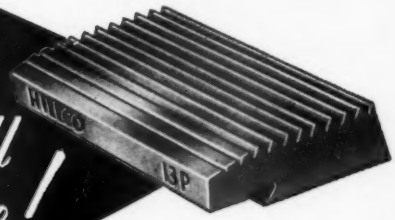
Write for catalogue

GEO. T. SCHMIDT, INC.
4112 Ravenswood Avenue
Chicago 13, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 901

"HILLCO" TANGENT CHASERS

We think you'll agree!



The new line of "HILLCO" Tangent Chasers, which can be re-ground for 80% of their original length, are guaranteed to be of highest grade tool steels ground to exacting tolerances. We feel that this complete line of chasers are the finest that we have produced in our 75 years of cutting tool manufacture. We think that you will agree with us.

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
1203 West 65th Street • Cleveland 2, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 903

GAGE COMPANY Deep-Etch
PRECISION PLASTIC • NON-BREAKABLE
COMPARATOR SCALES

Highly accurate and designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

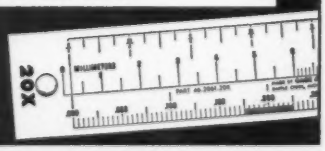
Supplied on Gage Company Precision Plastic . . . a sturdy, non-breakable material of constant stability, .125 in thickness.

Unexcelled as a tool for use in drafting and engineering scale layouts for use on comparators.

Available in all standard magnifications and in several lengths. Various styles for all applications.

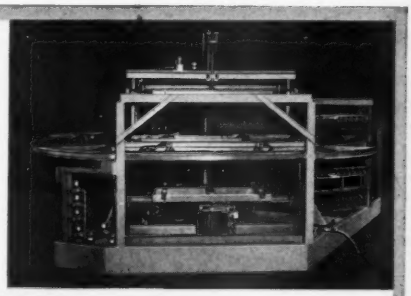
WRITE FOR BULLETIN NO. 58-70

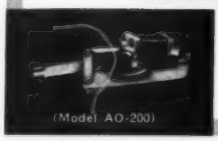
GAGE COMPANY
• • • BOX 1080
Battle Creek, Michigan



CIRCLE INFORM-A-GRAM KEY NO. 902

COOL IDEA




(Model AO-200)

FOR REFRIGERATOR MANUFACTURERS

Knu-Vise air-operated clamps are featured on a new 3-station automatic machine developed by the Brown Machine Company, Beaverton, Michigan, for vacuum forming inner door panels and other refrigerator parts at a maximum production rate.

The machine is completely automated with air clamps, mold table, vacuum system and fans, and rotating mechanism all operating from a single switch. 100 panels per hour—as big as 42" x 72"—can be produced.

Quality standards are so high that only dependable Knu-Vise air-operated clamps can be used. Take a tip—investigate Lapeer today!

Manufacturers of over 150 models of manually and air-operated clamps and pliers

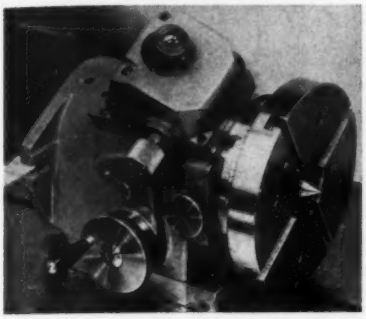
KNU-VISE PRODUCTS **LAPEER MANUFACTURING CO.**

3064 DAVISON ROAD
LAPEER, MICHIGAN

WESTERN DIV.: PECK and LEWIS CORPORATION
4430 Long Beach Ave., Los Angeles 58, Calif., ADams 3-7148
CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD.
1131 Pettit Road, Burlington, Ontario

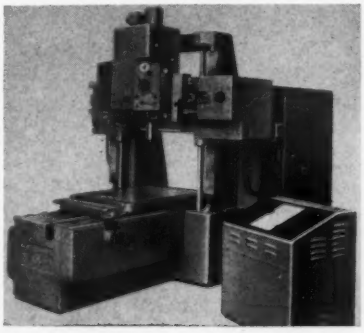
CIRCLE INFORM-A-GRAM KEY NO. 904

An Optical Dividing Head is designed for inspection and light machining purposes. A micrometer eyepiece provides direct readings to 2 sec of arc; while an external scale



ring is for coarse adjustment. Model OW12-OMT has a center height of 3¼" and with distance between centers of 14½". George Scherr Co., Inc., 200 Lafayette St., New York 12, or—**Circle Inform-A-Gram No. A50.**

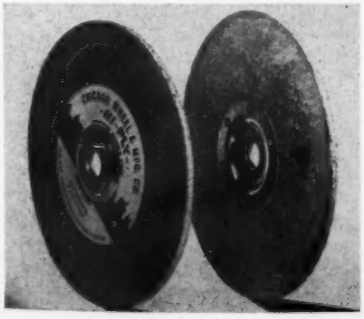
For Performing Exacting Machining and Measuring Operations use the Hydroptic 6A DIR jig boring and milling machine with coordinate repeating device. It was designed for



the manufacture and measurement of those precision parts which must be made in quantity and within limits beyond the scope of the conventional machine tools. American SIP Corp., 100 E. 42nd St., New York 17, or —

Circle Inform-A-Gram No. A51.

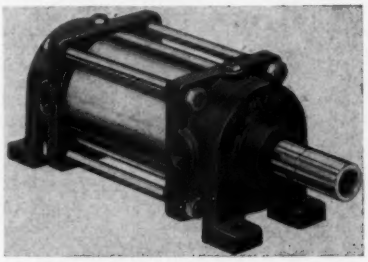
Depressed Center Wheels are suited for rough, tough production grinding, especially for grinding



weld, removing flash and bead, cleaning up rough ragged surfaces and edges on all types of stainless steel. A metal center bushing provides for quick mounting. They come in 7" and 9" dia and by 3/16" and ¼" thicknesses. Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, or —

Circle Inform-A-Gram No. A52.

Double-Acting Air Cylinders, featuring heavier construction and more accurate design, are available in horizontal, vertical, pivot or face mounted styles and with 1½", 2½", 3¼", and 4" bores. The basic cylinders are all alike but the mountings are interchangeable. For information, write Mead Specialties Co., Dept. AC-93, 4114 N. Knox Ave., Chicago 41, or — **Circle No. A53.**



NOW... DIEBEL

Hi-Production Automatic PRESSES

Join

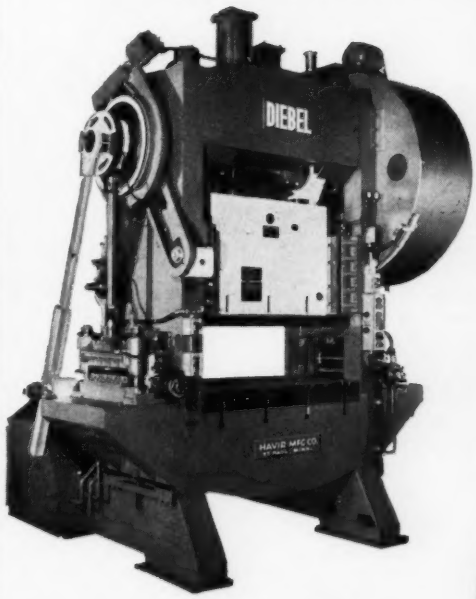
PRESS-RITE

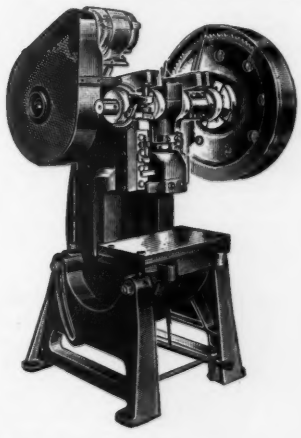
OPEN BACK INCLINABLE

Power Presses

150 TON DIEBEL
(Sizes 5 to 150 Ton)

30 TON PRESS-RITE
(Sizes 2 to 85 Ton)





Versatility or Hi-Production

Now, whichever meets your job requirements, the versatility of an O.B.I. Press or long runs at low unit cost on a Hi-Production Automatic Press, you can get the right press from one source.

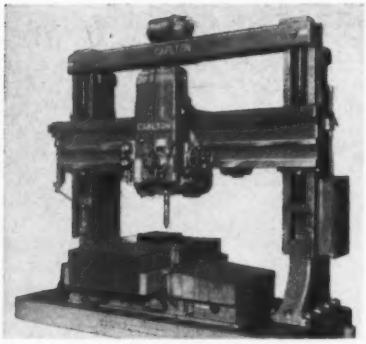
Both PRESS-RITE O.B.I. Power Presses and DIEBEL Hi-Production Automatic Presses are being built in the same plant. The same engineering, production and service that have built and backed PRESS-RITE Presses for over 20 years are now being applied to DIEBEL Hi-Production Automatic Presses.

Take your next press problem to your Dealer or write direct.

PRESS-RITE Division of
SALES SERVICE MACHINE TOOL CO.
2361 University Avenue
St. Paul 14D, Minnesota

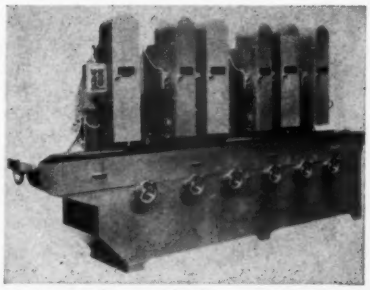
PRESS-RITE O. B. I. POWER PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 91



Automation is Applied to Heavy-Duty Production Hole Drilling and Boring with the Model 3AR double box column vertical drilling and boring machine produced for use with automatic positioning or spacing tables. Horizontal travel of head on rail is 28". For information, write The Carlton Machine Tool Co., Cincinnati 25, or — **Circle No. A54.**

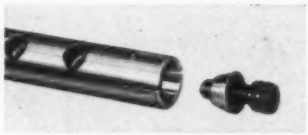
A Conveyor-Type Abrasive Belt Machine with 5" x 5½" piece capacity, makes possible six grinding operations in a single conveyorized pass. Designed for high-volume flat surfacing of ferrous and non-ferrous metals, the Model 680-6 can rough-grind, precision-size, and machine to a fine finish unmachined parts in one operation. Engelberg Huller Co., 831 W. Fayette St., Syracuse 4, or — **Circle Inform-A-Gram No. A55.**

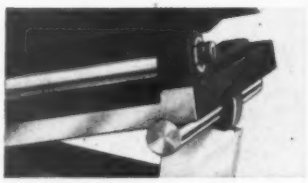


WHY *Robbins* IS YOUR BEST BUY

Only Robbins angular tooling equipment assures you positive accuracy when setting up to machine, grind or inspect angular work . . . because only Robbins gives you these exclusive features:

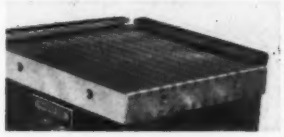
POSITIVE LOCKING locks firmly inside sine bar roll with expanding action for positive lock. Screw at each end locks toward front of unit, always pulls upper member firmly down on gage block without distortion. (Pat. app. for)





"PERMA-FLAT" SWIVEL BLOCK contacts gage block over entire face of swivel block instead of on a single thin line of contact. This patented feature provides greater contact between gage block and unit . . . combines with Robbins positive locking to assure the utmost accuracy.

FINE POLE ceramic magnet chuck, manufactured for Robbins by famed O.S. Walker Company, Inc. Strongest magnetic chuck available. Fine poles make it easier to set up smaller work, go right to the edge for easier setup next to rails.



IN ADDITION, both magnetic and non-magnetic models are built with ribbed base, intermediate and top plates for distortion-free strength and rigidity, with full-length ground roll seats for precision location, greater accuracy. All models make it possible to set up any angular work in just four simple steps . . . in minutes instead of hours! Before you purchase any sine plate, be sure you check Robbins' exclusive features. Write for new catalog!

OMER E. *Robbins* COMPANY
11961 DIXIE AVENUE DEPT. C DETROIT 39, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 92

Process Small and Medium Lots of Parts with a barrel finishing machine equipped with a built-in media separating system. The Model DBO-2A features a twin compartment barrel

which allows simultaneous deburring and finishing of different types of workpieces in one machine. Work loads up to 700 lbs can be handled. Almco-Queen Products Inc., Albert Lea, Minn., or — **Circle No. A56.**

A Load Measuring Instrument, Tool-Gard, for use on any machine tool operation, gives constant visual tool wear indication, and monitors

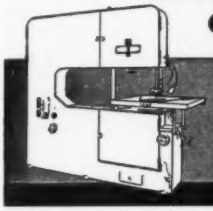
tool wear and machine operating conditions. It reveals the slightest increase or decrease in power consumption. Futurmill, Inc., 6360 Highland Rd., Pontiac, Mich., or — **Circle Inform-A-Gram No. A57.**

FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

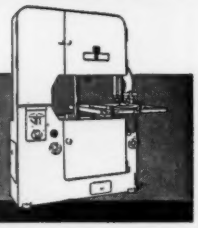
FASTEST, BEST MEANS OF CUTTING METALS

If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN ☎ GL-6-1729

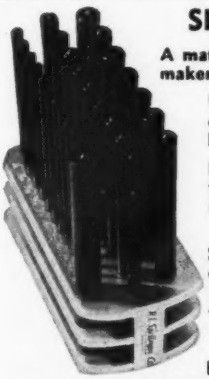


TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free DI-Saws on the market. Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 931

SPELLMACO SPOTTERS



A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 932

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Engineering Products Inc.
1515 Hurd Road, Monroe, Mich.

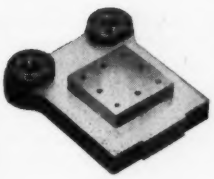
for fully illustrated catalog with accurate full size templates of assemblies

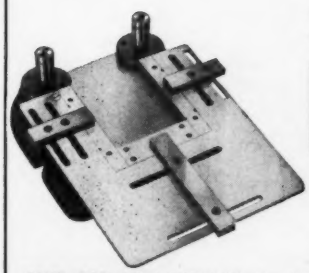
more than 1,000 details

CIRCLE INFORM-A-GRAM KEY NO. 933

Punches and Dies

Notching Die with Gauge Table





Standard stock sizes 4", 5" and 6". Lick those Notching Problems QUICKLY. Gauge table and gauging bars provide accuracy and speed with easy adjustment.

This is another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Precision made from high grade tool steel. Also adaptors and die shoes to convert your press.

26 *years of serving your punch and die requirements.*

What are your punch and die needs? Consult us about your problems. Prompt service on "Specials" made to your order.

SEND FOR FREE CATALOG No. 157 AF, illustrating our standard punches and dies and complete line of modern sheet metal fabricating equipment. **Net prices shown.**

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CIRCLE INFORM-A-GRAM KEY NO. 934

Tap Hard-To-Get-At Holes with taps larger than ½" with ease, accuracy, and economy with a series of tap extensions. They feature the Ritmar collet grip which permits dull or broken taps to be changed by hand, without the use of tools. 12" to 30" lengths are available. Ritmar Corp., 183 New York Ave., Huntington, L. I., N. Y., or —

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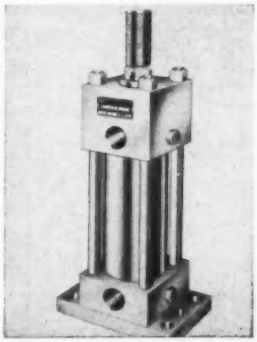
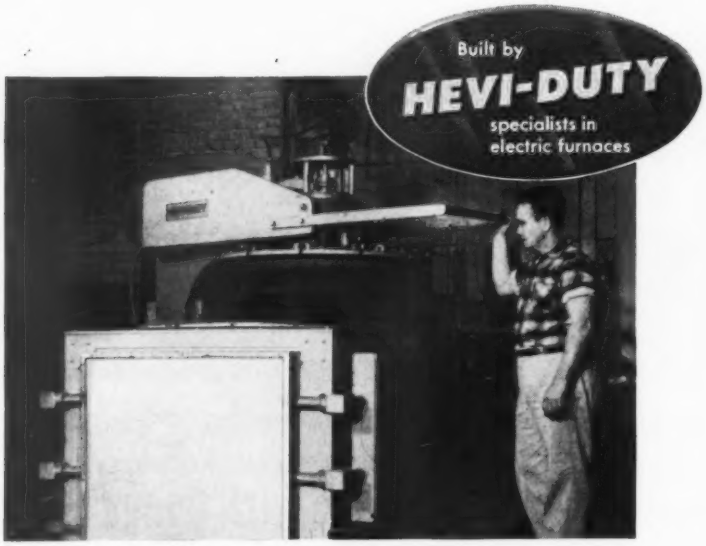
Heavy-Duty Air and Hydraulic Cylinders are designed for use on automated equipment such as machine tools, presses, transfer machines, welding machinery, and conveyors and dies. They have pressure ratings of 200 psi (air) and 1,000 psi (hydraulic). Bore sizes range from 1½" to 8". For information, write The S-P Mfg. Corp., 30201 Aurora Rd., Solon, Ohio, or — **No. A59.**





Steam Tempering in This Pit Furnace Improves Threading Machinery Parts at Landis

"We have noted a marked improvement in the quality of our taps and dies because of greater uniformity in heat treatment . . . not only throughout each load . . . but from load to load." In addition, Mr. Leckie-Ewing, the chief metallurgist at Landis Machine Company, Waynesboro, Pennsylvania, says that because the steam-tempering cycle is so easy to control, they can temper to within ± 1 point Rockwell C.

If your products require nitriding, bright or steam tempering, annealing, bright or special bluing or non-atmosphere heat treating requiring temperatures to 1350° F., you can achieve outstanding results with Hevi-Duty's new Versa-Duty Pit Furnace.

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- Heat Processing Furnaces
- Dry Type Transformers
- Constant Current Regulators

HEVI-DUTY ELECTRIC CO.
Milwaukee 1, Wisconsin

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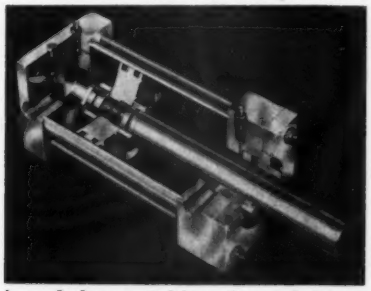
For Air Pressures of Up to 150 psi and oil pressures of up to 500 psi use a line of Squaremaster air cylinders. This cutaway view shows some of the features which include precision



honed brass tubing for minimum friction and wear, built-in check valves for smooth reversal, and replaceable cartridge-type piston rod bearings for easy servicing. Rivett, Inc., Brighton 35, Boston, Mass., or —

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Measure Both Internal and External Metal Cuts and Grooves, and accurately determine groove locations, using the Multi-Mike. Range

is from 0.050" to 1.050"; but in measuring lands, from 0 to 1". It will measure width of O-rings and retaining ring grooves, keyways, and lands between grooves. Consolidated Aircraft Products, El Segundo, Calif., or—**Circle Inform-A-Gram No. A61.**

Heavy-Duty Counterbores with either high speed steel or carbide tipped cutters are available from National Twist Drill and Tool Co.,

Rochester, Mich. The spline-taper drive feature insures permanent alignment and allows interchangeability of pilots, cutters, and holders.

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SPECIFY TOMCO FOR DEPENDABILITY

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in inch grams...inch ounces...inch pounds ...foot pounds (All sizes from 0-6000 ft. lbs.)

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- MINIMUM BORE 1/16"
- READINGS IN .0001"
- RANGE: .057" TO .828"
- 3 SETS, fully equipped with Rings and Measuring Heads for complete range.

DiaTest measures out-of-round, tapers, incomplete bores and all other variations to .00008" accuracy.

All parts available separately.

EACH SET complete with dial indicator in walnut case.

SET No.	RANGE	MEASURING HEADS	SETTING RINGS
E-1	.057"-.170"	8	8
E-2	.165"-.390"	9	9
E-3	.372"-.828"	9	9

NEW ACCESSORIES AVAILABLE

- RIGHT ANGLE ATTACHMENT — permits gaging without removing work-piece from under bore spindle.
- EXTENSION RODS—may be used to length of 30" without loss of accuracy.
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Automatic Universal

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- Drills as small as 1/16 inch dia.
- Spiral or straight taper reamers.
- Spiral or straight milling cutters and end mills.
- Sharpens saws up to 12 inch in diameter and in gangs up to 7¾" long.

AUTOMATIC INDEX FEED

Write for free Bulletin 90-FS

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CIRCLE INFORM-A-GRAM KEY NO. 954

Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

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HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

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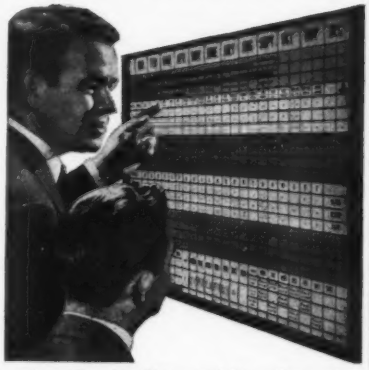
You Get Things Done With Boardmaster Visual Control



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ACME TOOL CORP.

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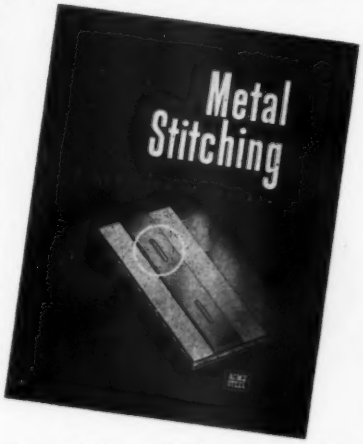
CIRCLE INFORM-A-GRAM KEY NO. 963

PUBLICATION PREVIEWS

"Metal Stitching, a New Idea in Fastening" is a 16-page booklet which gives detailed information on stitching metal to metal or metal to



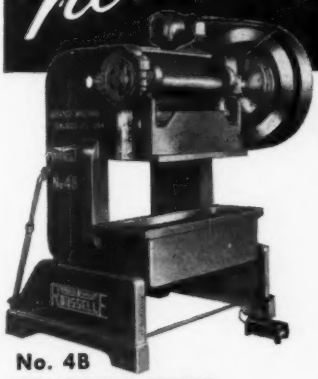
non-metallic materials and illustrates typical applications. Specifications are given for the metal stitchers. Get your copy from Acme Steel Co., 135th St. and Perry Ave., Chicago 27, or — **Circle No. B1.**

Miniature and Instrument Ball Bearings, sizes ⅝" OD and smaller, are introduced in a catalog from The Barden Corp., Danbury, Conn. Details on this line include tolerances, torque values, static and dynamic capacities, and limiting speeds. Contact the company for a copy of Catalog M1, or — **Circle No. B2.**

Eliminate Objectionable Noise created by the rotation of stock by using silent stock tubes described in a bulletin. With a stock tube, the bar rotates in a helically-wound, wear-resistant steel liner that has no sharp edges to damage stock. Bulletin SM37, from Brown & Sharpe Mfg. Co., Providence, R. I., gives details. **Circle No. B3.**

For Faster, More Precise Linear Measurement use Scan-A-Scales, precision optical measuring instruments. A folder tells how this instrument provides longitudinal, crosswise, or vertical settings to 0.0001", and also gives details on ease of use, mounting requirements, and directions for operations. Ask for Catalog SAS LM54 from F. T. Griswold Mfg. Co., 315 W. Lancaster Ave., Wayne, Pa. **Circle No. B4.**

New 40-TON DOUBLE CRANK O. B. I.
ROUSSELLE



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- Large die area.
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In Straight, Crank and Offset types. Many sizes. Will withstand severe usage. Neat. Ready for use.

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Including plastic and steel ball handles. C. I. Hand Knobs, Compression Springs, Balanced Cranks, Clamping Levers, etc.

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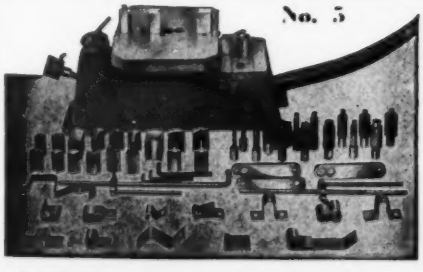
No. 5



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CUTS, BENDS, PUNCHES

Available in hand, air or hydraulic models. The MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛" x 1½" as illustrated. Punching dies available. Other models up to ½" x 8" hydraulic operated. Ideal for steel rule die forming.

ALSO AIR OPERATED MODELS

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Automatic RECESSING TOOLS

REDUCE INTERNAL FORMING COSTS

These fully automatic quickly adjustable tools save time, and cut costs on precision grooving, undercutting, inaccessible spot facing, chamfering, back facing and necking.

Maxwell Type JF Automatic Recessing Tools operate on the principle of an eccentric cutter holder actuated on its own axis. This is accomplished by the unique Maxwell Helical Gear and Diagonal Toothed Rack Mechanism.

They are used with jig or fixture on automatic or manual feed machines. Long-life circular form cutters, or tool bit holders with tool bits may be used. Location and diameter of recess are individually controlled by stop collars, adjustable to within ± 0.001-inch. Five sizes available to pilot into 1" to 2¼" bushings. Furnished with standard, adjustable adapter, quick change, straight or special shanks.

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388R-MC

THE MAXWELL COMPANY

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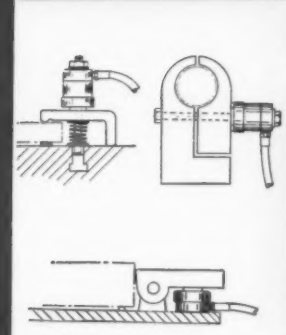

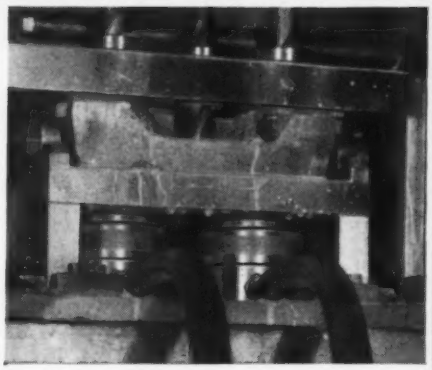

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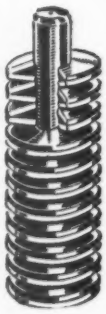

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5. Small construction height, large deflection.
6. Large inherent damping.
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Range: 3/8" to 3" for concave radii on lathes. Two sizes for convex radii (Balls up to 2½" dia.) on lathes. Also heavy duty model for radii to 6" on planers, etc.

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The Automatically Spring-Lifted, Triple-Purpose Chip Breaker is a feature of the T-Max toolholder described in a catalog. Diagrams show the wide range of speeds and cuts

which can be handled by the three fixed positions of the multi-purpose chip breaker. Catalog 542 is prepared by Sandvik Steel, Inc., 1702 Nevins Rd., Fair Lawn, N. J., or — **Circle Inform-A-Gram No. B5.**

Combine Rough and Finish Turning Operations on a single machine using the Model Q double-way, tracer-type automatic lathes covered in a bulletin. Specifications, features, and diagrams of tooling setups, chip disposal methods, and types of turning and squaring carriages are included. Bulletin Q-57 can be obtained from Seneca Falls Machine Co., 14 Fyfe Bldg., Seneca Falls, N. Y., or — **Circle No. B6.**

Greater Accuracy, Increased Production, and Lower Costs are features of the deep throat presses described in a bulletin. Capacities of eight bench and floor model presses ranging from 4 to 60 tons, with speeds of 90 to 195 spm, are discussed. Write to E. W. Bliss Co., Canton, Ohio, for a copy of Bulletin 5, or — **Circle No. B7.**

An Abrasive Belt Unit described in Bulletin 104 is used for almost every type of belt grinding and polishing within the capacity of its 2½" belt and 2 hp motor. For copies, contact Grinding and Polishing Machinery Corp., 2530 Winthrop Ave., Indianapolis 5, or — **Circle No. B8.**

Inclinable, Gap, and Straight-Side Power Presses are listed in a bulletin. Complete specifications for 34 press models are given in tabular form. Direct requests for copies of Bulletin 1958 to Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind., or — **Circle No. B9.**

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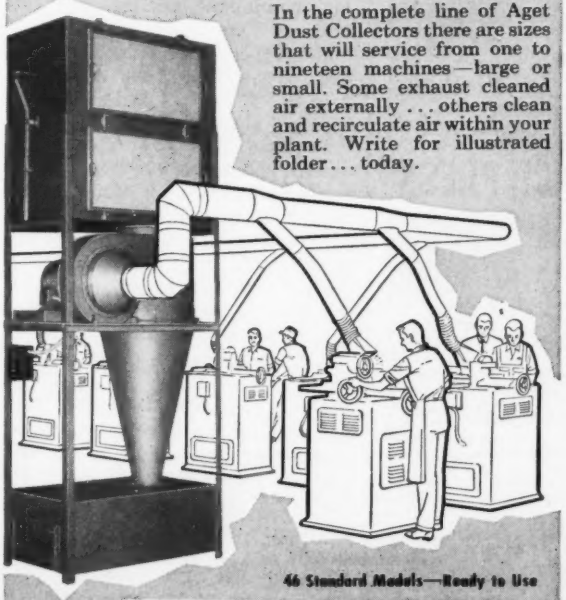
heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



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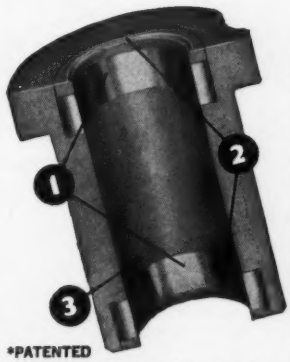

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W. F. MEYERS CO., INC., BEDFORD, INDIANA

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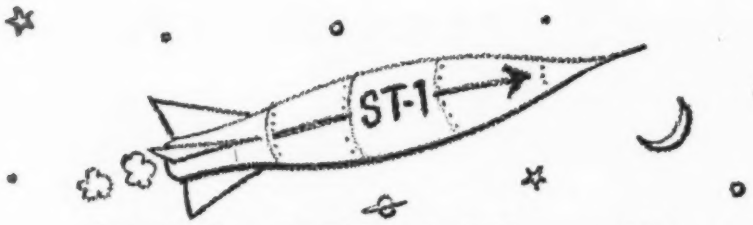

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Well, is it ram-jet powered?

It's got a ram alright, but it's hydraulically powered. Works real smooth and easy.

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What! We've got skilled people making the ST-1, it doesn't make hardly any noise.

Say, what kind of a missile is this?

The ST-1 isn't a missile, it's a tensile testing machine, and we've been making it and other quality testing machines for years. You better write for more information, friend!

DETROIT TESTING MACHINE COMPANY

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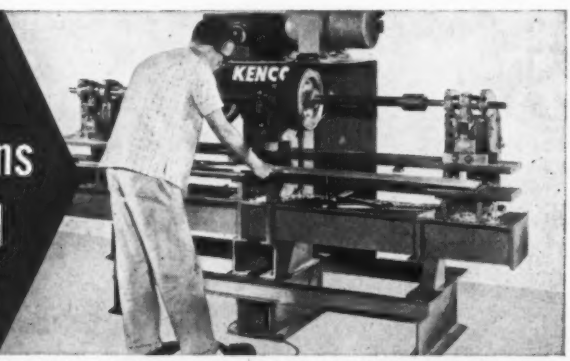
CIRCLE INFORM-A-GRAM KEY NO. 1001

Five Operations instead of one



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Eighty inches long—extruded aluminum strips are punched, dimpled and both ends slotted at the rate of 350 per hour on a special KENCO, ELECTRO-SAFE PUNCH PRESS. Die changes permit six different parts to be handled on this machine, one of which is 16 feet long.

The Press engineered and built by KENCO utilizes three Standard KENCO 5 ton presses arranged with a double drive on the Center Press with heavy connecting shafts which evenly distribute the torque loading. The ELECTRO-SAFE SYSTEM prevents accidental tripping because the motor is always "dead" except during a stroke. A dial controls "Single Stroke," "Continuous Stroke," or "Inching" operation.

You too can reduce your punching costs. Check with KENCO for Suggestions—there's no obligation.

Write for literature covering 2, 5, 8 and 15 ton Standard and Deep-Throated Models.

Job Facts: Machine: Special Kenco Punch Press • Material: Aluminum—80" long Extrusion • No. of Parts: 6—one is 16 feet long • Operation: 5—Punching, Dimpling, Slotting Ends • Production: 350 per hour.

2 Ton | 3 Ton | 5 Ton | 8 Ton | 15 Ton | Electro-Safe | Slow Speeds | Specials

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A Drilling-Layout Machine drills, reams, center punches, and scribes to produce templates and layouts rapidly. A bulletin gives features of

Model 25-A Flex-O-Drill and includes operating instructions and specifications. Get your bulletin from Wales Strippit Co., 212 South Buell Road, Akron, N. Y., or — **No. B10.**

For Die Casting Dies and other hot work tools, use Viscount 44, presented in a new bulletin. It is prehardened to Rockwell C 42-46, needs no heat treatment, has superior resistance to wash and heat checking, and is machinable in pre-hardened state. Write to Latrobe Steel Co., Latrobe, Pa., for your copy, or — **Circle Inform-A-Gram No. B11.**

Motorized Rotary Tables, offered in a bulletin, are rugged and precision built to adapt most milling, drilling, and boring machines for a variety of operations such as automatic indexing, continuous milling, and cycle milling. Dimensions are given in a bulletin from W. B. Knight Machinery Co., 3920 W. Pine Blvd., St. Louis 8, or — **Circle No. B12.**

Protect Sensitive Instruments against shock and vibration with the bonded rubber Meter Mounting presented in a bulletin. It contains information about advantages and performance, and installation photographs show typical applications. Bulletin 601 is available from Lord Mfg. Co., 1635 W. 12 St., Erie, Pa., or—**Circle Inform-A-Gram No. B13.**

More than 800 Go-No-Go Gages are summarized in a bulletin which gives specifications of a complete line of plug gage sets in chart form for quick reference. Also included are suggestions for uses. Direct requests for this bulletin to K&K Grinding Co., 230 Richardson St., Brooklyn 22, N. Y., or — **No. B14.**

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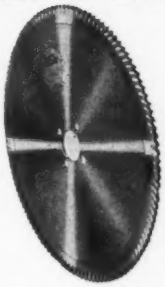
GIVES SAW MAINTENANCE AND CUTTING TIPS ON COLD CUTTING OF METAL



If you use segmental circular cold saws to cut metal, you need this chart. It's designed for quick and easy reference when saw problems occur. The chart measures 20½" x 14½" and is mounted on heavy cardboard suitable for hanging on wall or machine. It is divided into four major sections listing common cutting problems and their solution. It is prepared by the world-famous Firth Brown Tools, Ltd., of Sheffield, England, manufacturers of Insto Segmental Saws — THE SAW THAT COSTS LESS NEW THAN RESEGMENTING OLD BLADES.

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For Tube Rolling, Tube Cutting, and Maintenance Operations, use the tube expanders, tube cutters, and other tube tools listed in a catalog. Charts of specifications are given for each item, with diagrams included. The Gustav Wiedeke Co., 1833 Richard St., Dayton 1, Ohio, supplies copies of Catalog 81, or — **No. B15.**

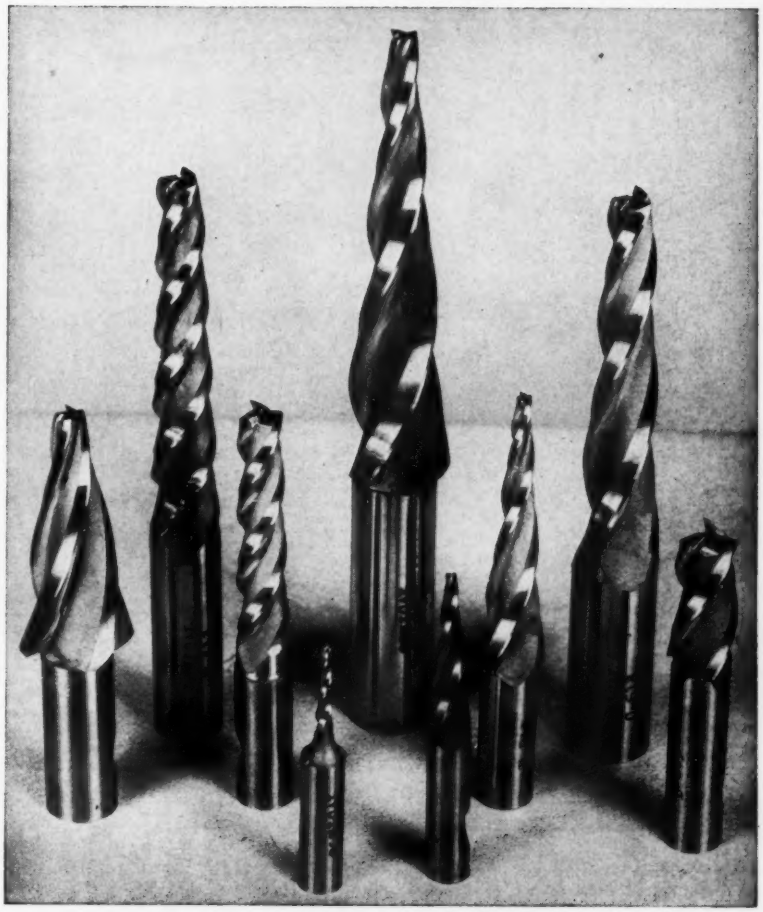
Two Vises which convert the ordinary drill press and bandsaw into complete machine tools are discussed in "Step Up Production." Also described are fully automatic instant-change chucks and automatic tapping attachments. Copies of this catalog can be obtained from AMF Tool Div'n, 224 Glenwood Ave., Bloomfield, N. J., or — **Circle No. B16.**

Tips on How to Use Cutting Tools to best advantage are found in a bulletin from The Heald Machine Co., 1 New Bond St., Worcester 6, Mass. The importance of angle, shape, and finish to provide maximum production with highest accuracy and precision is explained, and formulas for determining speeds and feeds are included. Several diagrams illustrate terminology of single-point boring tools. Write to the company for a copy, or — **Circle Inform-A-Gram No. B17.**

A Centralized Lubrication System for built-in measured lubrication is discussed in a catalog which presents the component parts of the system, gives application data, and explains the procedure for installing the system. Contact Alemite, Div'n of Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago 14, for a copy of Catalog 34-28, or — **Circle No. B18.**

"Tool Steels for The Die Casting Process" describes and illustrates the process and equipment used, and a chart lists the requirements for all die casting tools. Data on quenching, tempering, nitriding, and the influence of lubrication is also included. Get a copy of this bulletin from Crucible Steel Company of America, The Oliver Bldg., Pittsburgh 22. **Circle No. B19.**

"Dial Type Milling Machines" is the title of a 45-page catalog which gives information on Cincinnati Milling's plain, vertical, and universal dial types. Design features are illustrated and explained, and specifications are listed. Write to The Cincinnati Milling Machine Co., Cincinnati 9, for a copy of Publication M-2003, or — **Circle No. B20.**



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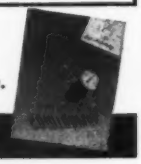

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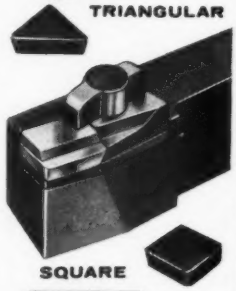

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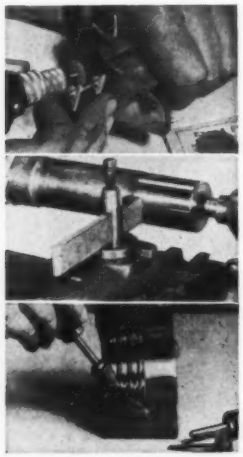

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Diamond Grip Collets for turret lathes are highlighted in a bulletin from Sutton Tool Co., Sturgis, Mich. Information on solid collets, master collets, and collet pads are listed in tabular form for easy reference. Bulletin 20 is available from the company, or — **Circle No. B22.**

Vibratory Parts Feeders and parts feeder components are described in a bulletin which lists five standard electromagnet-driven bowl-type models and six standard electromagnetic transfer and storage models. Write to Syntron Co., 341 Lexington Ave., Homer City, Pa., for your copy, or—**Circle Inform-A-Gram No. B23.**

A Carbide Inserted Bushing Catalog has been announced by W. F. Meyers Co., Bedford, Ind. In addition to the complete descriptions and specifications for slip renewable and fixed renewable sub bushings, this catalog includes information on head and headless press fit types. Direct requests for copies to the company, or—**Circle Inform-A-Gram No. B24.**

An 80-Page Catalog contains specifications on the entire line of South Bend machine tools. Information on engine lathes, toolroom lathes, turret lathes, presses, grinders, milling machines, and several new items is included. Get Catalog 5800 from South Bend Lathe Works, S. Bend 22, Ind., or—**Circle Inform-A-Gram No. B25.**

An Index Plunger, for fixture construction, that can be hand-operated or adapted to mechanical operation, is one of the products discussed in a catalog sheet from West Point Mfg. Co., 26935 W. 7 Mile Rd., Detroit 19. Specifications and a detailed diagram are included. **Circle No. B26.**

"Short Cuts and Savings with Kodagraph Reproduction Materials" diagrams seven applications for the materials, which include protection of original drawings, simplification of print distribution, and reproduction of blueprints and direct-process prints. Graphic Reproduction Div'n, Eastman Kodak Co., Rochester, N. Y., or—**Circle Inform-A-Gram No. B27.**

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0" to 3" range . . . accurate to .000025"!

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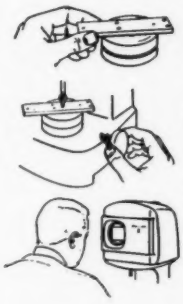

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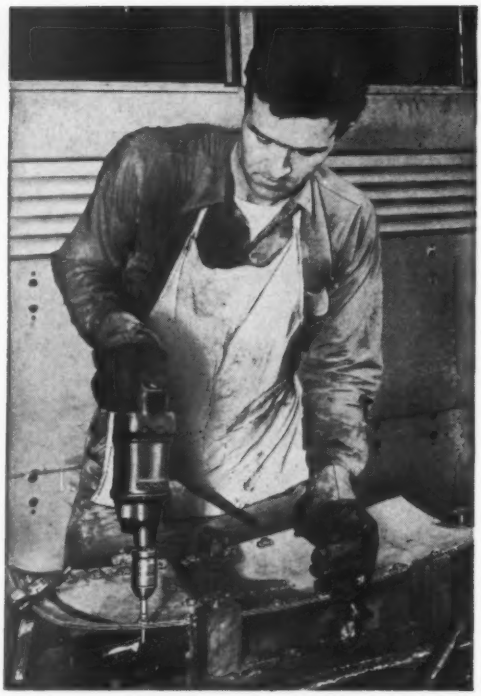

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High Speed Steel Throw-Away Inserts, stocked in Circle "C" and Van Chip grades, are particularly adaptable for difficult high temperature alloy turning applications. A data sheet shows both triangular and square inserts, with specifications and diagrams of cutting angles. Firth Sterling Inc., 3113 Forbes Street, Pittsburgh 30, supplies Bulletin MTI-35, or — **Circle No. B28.**

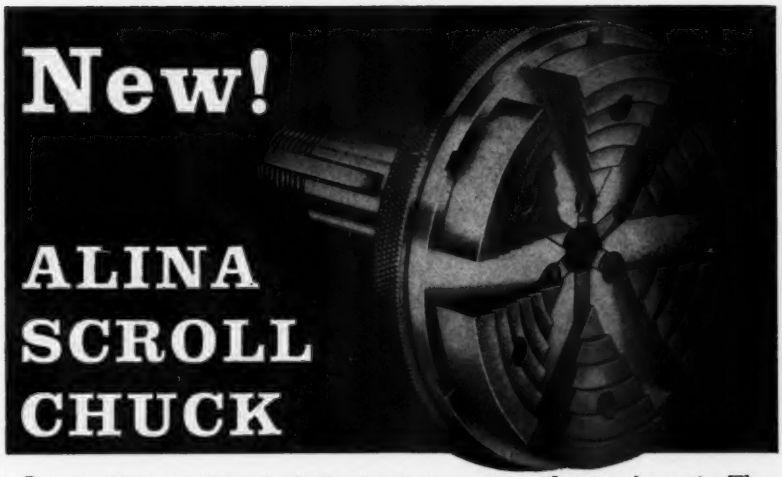
Handle Bulk Items of all sizes and shapes from raw materials to finished products with wirebound pallet boxes, detailed in a catalog. They can be used as assembly, production, storage, and intra-plant materials handling bins as well as for shipment. Applications and dimensions are given in this bulletin from Wirebound Box Manufacturers Assoc., 222 W. Adams St., Chicago 6, or — **Circle Inform-A-Gram No. B29.**

A Work Driver for use on any type of engine lathe, multiple tool lathe, or plain or universal grinder is the subject of a new bulletin. Illustrations show use on these machines. Specifications and diagrams are included. Bulletin D-57 is published by Seneca Falls Machine Co., 13 Fyfe Bldg., Seneca Falls, N. Y., or — **Circle Inform-A-Gram No. B30.**

How to Contour Machine Unsupported Honeycomb Cells is explained in a bulletin, along with descriptions of Gantry-type honeycomb contour milling machines. Information on tooling and fixture setups required for these operations is included. Write Onsrud Machine Works, Inc., 7720 N. Lehigh Ave., Niles, Ill., for Bulletin 1167, or — **Circle No. B31.**

A 108-Page Valve Catalog is divided into the following sections: 4-way valves and manifolds; 2- and 3-way line valves; manual valves and manifolds; and pilot and special valves. Applications and operational data, specifications, and dimensional drawings are included along with handy valve selection charts and J.I.C. symbol diagrams. Get your Catalog 58 from Numatics Inc., Highland, Mich., or — **Circle No. B32.**

"High Reliability" is a 15-page booklet which tells the story of the need for greater reliability in all industries because of competition, automation, safety, etc. It explains why this factor is so important to today's manufacturing, and how reliability must and can be economical. Get your copy from Standard Pressed Steel Co., Jenkintown, Pa., or—**Circle Inform-A-Gram No. B33.**



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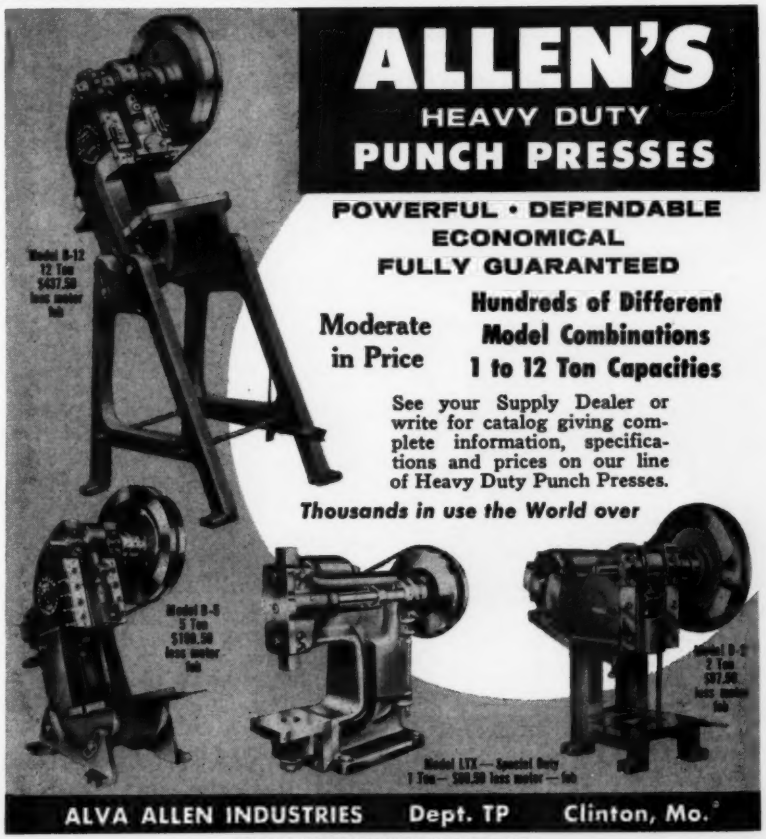
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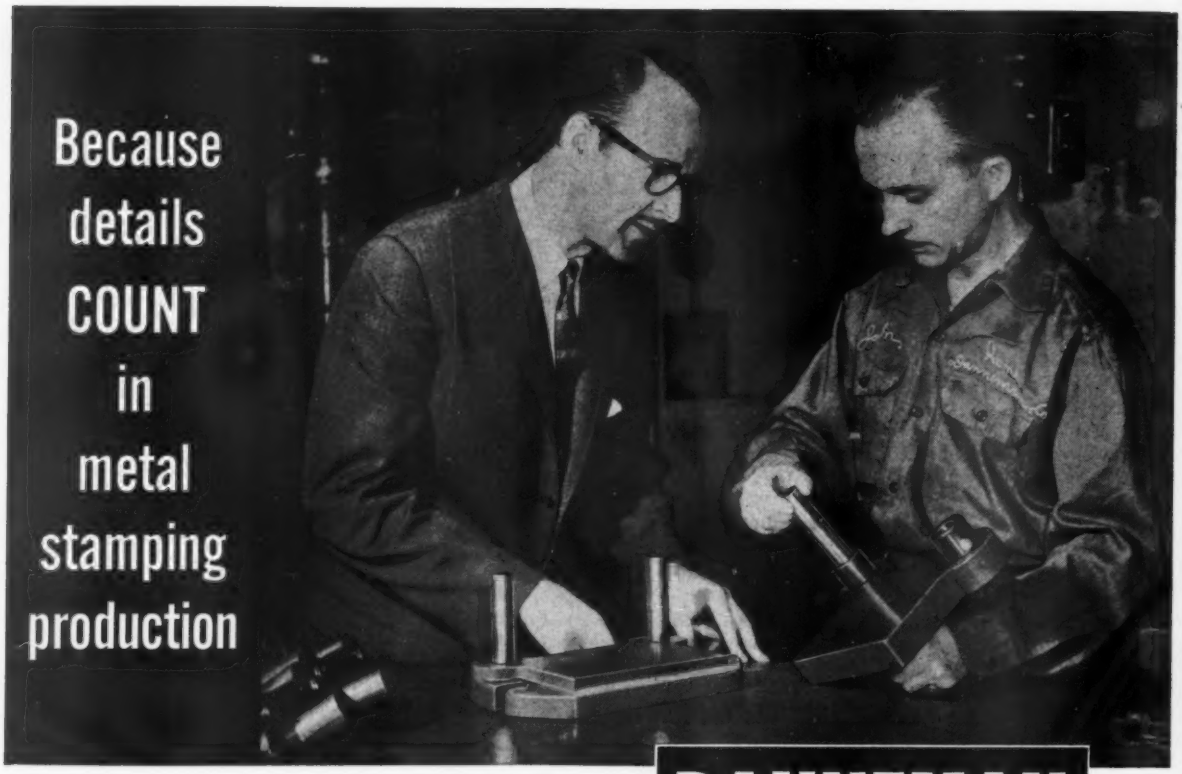

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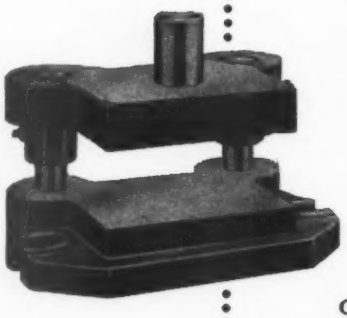

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All Types of Machine Tools are listed in a bulletin which gives specifications along with the pictures and diagrams of the products. Cutters, mounted wheels, rotary files and cutters, brushes, and drills are a few of the items included. Get your catalog from Schupack Supply Co., 7331 Cottage Grove Ave., Chicago 19, or — **Circle Inform-A-Gram No. B34.**

Press Equipment is presented in a catalog which gives features and specifications of a full line of reeling, straightening, feeding, and scrap handling equipment for power presses, power shears, etc. Catalog 58 is published by Cooper Weymouth, Inc., 600 Honeyspot Rd., Stratford, Conn., or—**Circle No. B35.**

A Hard Surfacing Spray Powder, Kenspray, produces a hard surface overlay, tightly bonded to the base metal, and has a high resistance to abrasion, corrosion, and impact. Kenspray applications, specifications, and equipment are described in Bulletins L-5 and L-6 from Kennametal, Inc., Latrobe, Pa., or — **No. B36.**

Forty-seven Sizes of Lightweight, Tri-Metal Tumble Box Jigs, ranging from 1" x 1" x 1" to 4" x 8" x 4", are listed in a bulletin. Construction features such as the interlocking leg joints which assure greater strength and stability, are described. Contact Standard Parts Co., 1030 Broadway, Bedford, Ohio, or — **Circle No. B37.**

A 16-Page Vise Catalog includes illustrations and descriptions of some of the manufacturing operations and important features of machinist's vises. A comparison chart enables vise users to specify requirements more easily. Write The Desmond-Stephan Mfg. Co., Urbana, Ohio, for Catalog 80, or — **Circle No. B38.**

Raise Welding Quality using the mechanized "Squirt" welder which combines the advantages of automatic submerged arc with the versatility of manual electrodes. Features and specifications are given in a bulletin available from The Lincoln Electric Co., Cleveland 17, or — **Circle Inform-A-Gram No. B39.**

Permanent Magnets, magnetizers, and demagnetizers are highlighted in a bulletin from The Indiana Steel Products Co., Valparaiso, Ind. Over 70 cast Alnico V magnets and over 30 sintered Alnico II magnets are listed. Illustrations and diagrams accompany the many different sizes and shapes. Write to the company for Catalog PR-19, or — **No. B40.**

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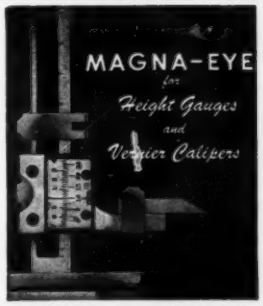

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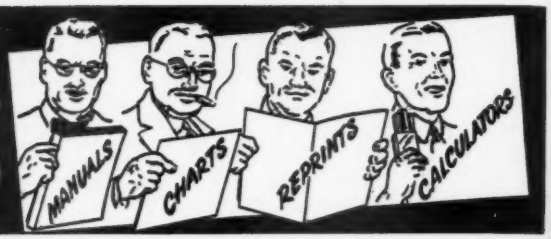

A Slide Rule facilitates the selection of matched ring gages for external threads and plug gages for internal threads, in both numbered and fractional sizes. Explanations of the different classes of threads are also included. Write to The Sheffield Corp., Dayton 1, Ohio, for a copy of this selector, or —

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Avoid Costly Errors by periodically checking surface plates as suggested in a Rahn brochure. It covers a method of calibrating worn surface plates, formula for determining the cost, ways of grinding out nicks, and care of granite surface plates. Rahn Granite Surface Plate Co., 638 N. Western Ave., Dayton 7, Ohio, supplies copies, or —

Circle Inform-A-Gram No. C2.

"Air Power Automation" gives ideas on how to solve your air power problems. Detailed diagrams show typical hookups, and operational sequences are numbered and explained. Applications are also given for many of the products illustrated in this bulletin available from Mead Specialties Co., 4114 N. Knox Ave., Dept. TF-P-93, Chicago 41, or —

Circle Inform-A-Gram No. C3.

Physical Properties and Characteristics of Diamonite high alumina ceramic standard and special products are discussed in a folder. It contains individual informative catalog sheets and other technical information. Contact Diamonite Products Mfg. Co., 1232 Cleveland Ave., N.W., Canton 3, Ohio, for a copy, or —

Circle Inform-A-Gram No. C4.

"Titanium Welding Techniques," a 32-page booklet, outlines procedures required for successful titanium welding. A study of typical weldments and methods for evaluating weld quality are included. The booklet also contains outlines of welded joint designs, mechanical properties of weldable grades of titanium, and recommended settings for open air machine welding. Get a copy from Titanium Metals Corporation of America, 233 Broadway, New York 7, or **Circle Inform-A-Gram No. C5.**

Four Hot Worked Tool Steels used in the hot extrusion of ferrous and non-ferrous metals, die casting, and brass die casting, are outlined in data sheets. Typical analysis is given in chart form, and forging, annealing, hardening, and tempering characteristics are included. Contact A. Milne & Co., Inc., 67 W. 44 St., New York 36, for copies, or —

Circle Inform-A-Gram No. C6.

Induction Heating is explained and specific examples of how this process helps increase production and lower costs are given in a bulletin. It shows where production economies are possible with induction heating, and gives applications of it. Write to Magnethermic Corp., Youngstown, Ohio, for a copy of this bulletin, or —

Circle Inform-A-Gram No. C7.

A Brazing Manual contains data for brazing shapes, sheets, castings, tubing, and assemblies of aluminum, cast iron, copper, brass, and steel. Diagrams and explanations of joining operations show how sound joints can be made without highly-skilled workers. Bulletin 21958 is available from All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y., or — **Circle No. C8.**

A Slide-Rule Type Selector gives standard sizes for over 30,000 drill bushings. It designates OD and ID of liners in decimals, shows head sizes of shoulder types, and indicates proper lockscrews for all slip fit bushings. For your pocket selector, write Acme Industrial Co., 200-222 N. Laflin St., Chicago 7, or — **No. C9.**

Uses and Advantages of Emulsifying Cutting Oil are listed in a technical bulletin from Sun Oil Co., Philadelphia 3. Characteristics are discussed and an outline of test results and listing of emulsion mixing instructions are included. Get Bulletin 16 from the company, or —

Circle Inform-A-Gram No. C10.

A Set of Three Plastic Tool Clamp Templates save drafting and tool designing time. The three templates combined contain over 30 different figures and they're free. Write to PIC Design Corp., 477 Atlantic Ave., E. Rockaway, L. I., N. Y., or —

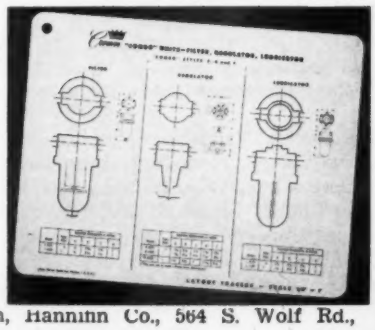
Circle Inform-A-Gram No. C11.

System Planning Data of Accumite centralized lubrication is discussed in a bulletin. Sections include analysis of machine bearings, selection of lubrication interval, system components, appropriate lubricant, and installation procedure. Relative performance of oils and light greases is given in chart form for easy selection. Get bulletin 34-28A from Alemite, Div'n of Stewart-Warner Corp., Chicago 14, or —

Circle Inform-A-Gram No. C12.

"The ABCs of Colloidal Dispersions" gives the answers to questions about colloids. Graphite, colloidal graphite, and molybdenum disulfide are discussed. "Why is a colloidal dispersion better than a dry powder?", "Why is graphite dispersed in various fluids?" and "What other solids do we disperse?" are several of the questions answered. Write Acheson Colloids Co., Port Huron, Mich., for a copy, or—**Circle No. C13.**

Sets of Layout Tracers make it easy to "lay in" various units of the Hannifin Crown line of filters, regulators, lubricators, and accessories. Outlines of the various units are shown to scale on permanent cards which are slipped under the tracing. Directions for use and helpful design tips are also printed on the eight cards. For your set, write on your company letterhead to Mr. H. J. Andresen, Crown Products Div'n, Hannifin Co., 564 S. Wolf Rd., Des Plaines, Ill.



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Business Management Aids

A Guided Missile Data Sheet lists all missiles for the Air Force, Army, and Navy by name and purpose, and gives the names and addresses of the prime contractors as well as component sub-contractors. Information on anti-aircraft missiles, airplane attack missiles, and inter-continental ballistics missiles is given. La Salle Steel Co., P. O. Box 6800-A, Chicago 80, supplies copies of the data sheet, or —

Circle Inform-A-Gram No. F1.

Floor Care Costs, slips and falls, replacement expenses, and good looks are considered in a booklet, "What Every Executive Should Know About this Vital Thousandth of an Inch." It describes flooring, cleaners, sealers, and equipment suitable for different jobs in office and factory. Write to Massury-Young Co., 76 Roland St., Boston 29, for your copy, or —

Circle Inform-A-Gram No. F2.

Steel Shop Equipment, suitable for production, assembly, layout, inspection, packing, and cutting, is described in a bulletin. Specifications for workbenches, portable and semi-portable units, tool stands, shop desks, and table and accessory components are given. Borroughs Mfg. Co., Sub. of American Metal Products Co. of Detroit, 3002 N. Burdick, Kalamazoo, Mich., or —

Circle Inform-A-Gram No. F3.

Protect Your Business against legal and financial tangles possible when an important member of an organization dies. A booklet gives ideas on how to protect the partnership, closed corporation, sole proprietorship, or against the loss of a key man, by having business life insurance. "Will This Man Take Your Business With Him When He Dies?" is available from Aetna Life Insurance Co., 151 Framington Ave., Hartford 15, Conn., or — **Circle Inform-A-Gram No. F4.**

"Calculation of Depreciation Charges and Reserves with Univac 120" describes lawful optional costing methods available for reducing taxes. One way is the use of the "declining balance" or "sum-of-years-digits" method in calculating depreciation charges. An accurate "depreciation by cost center" method is also described. Bulletin U-1113 is available from Remington Rand Univac Div'n, Sperry Rand Corp., 315 4th Ave., New York 10, or —

Circle Inform-A-Gram No. F5.

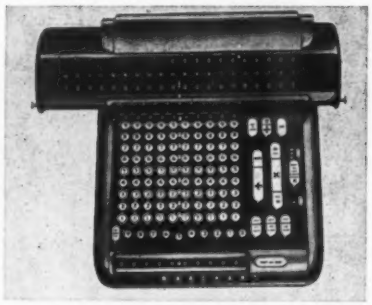
Steel Storage Lockers are described in a bulletin available from Penco Metal Products Div'n, Alan Wood Steel Co., 200 Brower Ave., Oaks, Pa. Twelve locker styles are presented and tables show available sizes. Get Bulletin B-60 from the company, or —

Circle Inform-A-Gram No. F6.

"Basic Data on Industrial Tennessee" gives the complete picture of the advantages offered to industry by this state. The markets, labor, raw materials, fuel and power, transportation, living conditions, and recreational facilities are some of the subjects covered in the bulletin. Get your copy from Tennessee Industrial and Agricultural Development Commission, Cordell Hull Bldg., Nashville 3, or —

Circle Inform-A-Gram No. F7.

Completely Automatic Positioning of all decimals and all carriage dials is one of the features of the Deci-Magic, a single-keyboard automatic electric calculator. Other features include automatic single-entry



squaring, automatic half-cent round-off, automatic accumulation of products and quotients, and grand total accumulation. Contact Marchant Calculators, Inc., Oakland 8, Calif., for more information, or —

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"Answers Are Our Products" is a booklet which tells how to save time, reduce overhead, eliminate peak loads, and increase profits by using data processing services available by the hour or job. Payroll records, rate studies, production records, physical inventory reports, and scientific computations can be handled. For your booklet, write to The Service Bureau Corp., 425 Park Ave., New York 22, or —

Circle Inform-A-Gram No. F9.

Industrial TV can be used for surveillance and inspection, remote recording of instruments, and demonstration and instruction. A bulletin diagrams the multi-camera, multi-monitor, remote-control systems. Copies are available from Philco Corp., Government and Industrial Div'n, 4700 Wissahickon Ave., Philadelphia 44, or —

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A Vertical File for single large sheets such as blueprints, drawings, and plans handles each sheet individually. They hang without getting wrinkled or creased. The file holds 150 aluminum hangers and the sheets are held in place by Plan Hold tubular tape. For information, write Plan Hold Corp., 5204 Chakemco St., S. Gate, Calif., or —

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How a New Production Control System makes possible the extension of automation benefits to general manufacturing systems is explained in a brochure. This Telecontrol system is outlined and the brochure tells how planning and scheduling, automatic counting, and simplified paperwork are possible. Get your copy from Control Systems Co., Div'n of Hancock Industries Inc., Jackson, Mich., or —

Circle Inform-A-Gram No. F12.

Copyflex Copying will reproduce written, typed, printed, or drawn originals on ordinary translucent paper, in seconds. Order-billing, production control, purchasing-receiving, and accounting are the four basic uses for the Copyflex. The process is described and techniques for a variety of jobs are discussed in a bulletin. Write to Charles Bruning Co., Inc., 1800 W. Central Rd., Mt. Prospect, Ill., for your copy, or —

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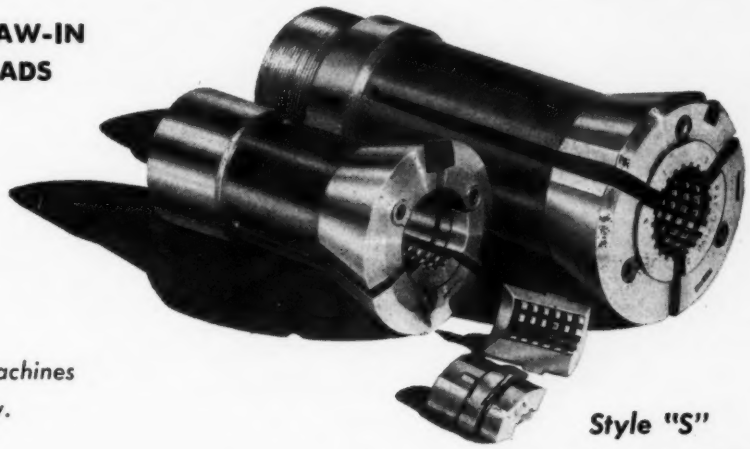

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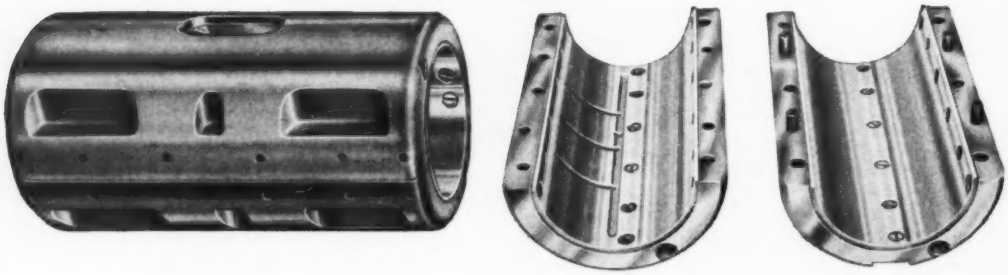
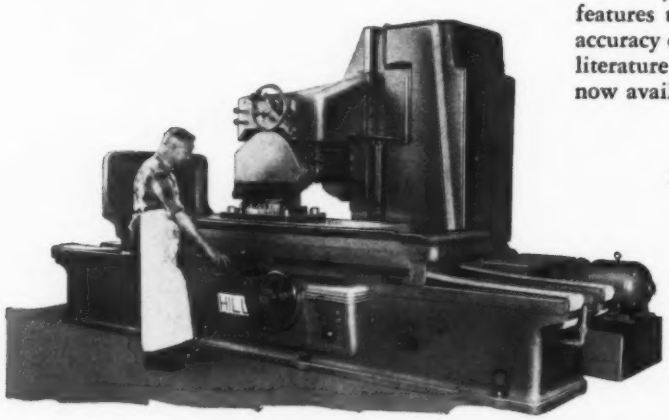


The front spindle bearing on HILL horizontal spindle hydraulic surface grinders was engineered by the HILL ACME COMPANY and has proven in the field to operate indefinitely. An alloy bronze bushing is fastened to a semi-steel casting with brass screws. The bronze bushing is undercut lengthwise in four equidistant locations on the outside diameter to allow for spindle expansion. (Darker areas in photo show undercut sections.) A perfect bearing surface is established in the I.D. of the bronze directly opposite the undercut sections. Oil is forced into specially designed concave relief areas which act as oil wedges assuring long bearing life. Hardened dowel pins guide the two halves together to their original position. The bottom half of the bearing has an oil return slot shown at the edge of the half section on the outside diameter. Note that there are NO oil grooves in this bottom half or in the quarter half of the top section. The shaft rotation spreads the oil film from the oil distribution grooves to the perfect bearing surfaces. Any additional oil grooves would act as scrapers and be detrimental to the oil film formed around the spindle.

This is just one of the many exclusive construction features that result in the longer life and permanent accuracy of HILL heavy duty surface grinders. Detailed literature on these high-precision machine tools is now available.



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CIRCLE INFORM-A-GRAM KEY NO. 114

READER SERVICE CARD JULY 1958 ISSUE

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ADVERTISEMENTS

2	21	57	77	121	884	963	1021	1092
3	22	58	79	781	891	971	1022	1093
4	23	59	80	782	892	972	1023	1111
5	24	60	82	783	893	973	1024	1112
6	25	61	83	781	901	974	1031	1113
7	26	62	85	782	902	981	1032	1114
8	27	63	87	783	903	982	1033	1181
9	28	64	88	784	904	983	1034	1182
10	29	65	91	785	931	991	1041	1231
11	30	66	92	811	932	992	1042	1232
12	31	67	94	812	933	993	1043	1233
13	32	68	105	813	934	1001	1044	1251
14	34	69	108	841	951	1002	1061	1252
15	51	70	113	842	952	1011	1062	1271
16	53	71	114	843	953	1012	1063	1272
17	54	73	115	861	954	1013	1071	1291
19	55	74	117	862	961	1014	1072	1292
20	56	76	119	863	962	1015	1091	

EDITORIAL ITEMS

A1	A19	A37	A55	B11	B29	C7	F9
A2	A20	A38	A56	B12	B30	C8	F10
A3	A21	A39	A57	B13	B31	C9	F11
A4	A22	A40	A58	B14	B32	C10	F12
A5	A23	A41	A59	B15	B33	C11	F13
A6	A24	A42	A60	B16	B34	C12	
A7	A25	A43	A61	B17	B35	C13	
A8	A26	A44	A62	B18	B36	D1	
A9	A27	A45	B1	B19	B37	D2	
A10	A28	A46	B2	B20	B38	D3	
A11	A29	A47	B3	B21	B39	F1	
A12	A30	A48	B4	B22	B40	F2	
A13	A31	A49	B5	B23	C1	F3	
A14	A32	A50	B6	B24	C2	F4	
A15	A33	A51	B7	B25	C3	F5	
A16	A34	A52	B8	B26	C4	F6	
A17	A35	A53	B9	B27	C5	F7	
A18	A36	A54	B10	B28	C6	F8	

Which article in this issue was of most interest to you? _____

THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING and PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

Our reader service department is handling over 100,000 reader inquiries per year and it is essential that the blanks at the top of each card be filled in accurately and completely. Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.

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A8	A26	A44	A62	B18	B36	D1	
A9	A27	A45	B1	B19	B37	D2	
A10	A28	A46	B2	B20	B38	D3	
A11	A29	A47	B3	B21	B39	F1	
A12	A30	A48	B4	B22	B40	F2	
A13	A31	A49	B5	B23	C1	F3	
A14	A32	A50	B6	B24	C2	F4	
A15	A33	A51	B7	B25	C3	F5	
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Hollow Mill Maker finds

DBL-2
High Speed Steel

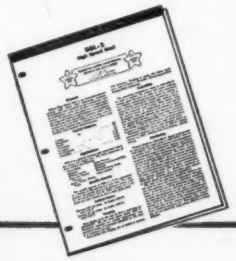
HARD, TOUGH and VERSATILE

The maker of these adjustable hollow mills required a steel that would give top performance in a variety of jobs—turning, tapering, facing, chamfering and trepanning. After thorough testing, Allegheny Ludlum's high speed DBL-2 was selected.

DBL-2 is an improved general-purpose high speed steel. It contains tungsten, molybdenum and vanadium in such proportions that it excels 18-4-1 for most applications. DBL-2's unusual combination of high hardness with toughness, its ability to hold a fine grain over a wide hardening range, and the fact that it easily machines many diverse types of stock, made it particularly well suited for this job.

In addition to these advantages, DBL-2 can be heat treated in the same furnaces and atmospheres as 18-4-1 without fear of harmful decarburization. These DBL-2 blades were heated to 2250 F., oil quenched and drawn twice at 1025 F. After heat treatment, blades easily machined such stock as aluminum, stainless steel, carbon steel, aircraft steel, plastics, bronze, screw stock, cast iron and brass.

There is an A-L tool steel to meet your toughest requirements. For further information call your A-L representative or distributor today, or write . . . .
Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.



Write for BLUE SHEET on DBL-2

Gives all needed handling and shop treatment details on DBL-2. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc.

ADDRESS DEPT. TP-7

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

Allegheny Ludlum

WSW 7105

AL® FINE TOOL STEELS SINCE 1854

CIRCLE INFORM-A-GRAM KEY NO. 115

MANUFACTURING MEMOS

Division Renamed . . .

• The Ingersoll Products Div'n of Borg-Warner Corp. has made known that the division's Industrial Crane & Hoist operation has been renamed Borg-Warner Industrial Cranes. This is to identify Borg-Warner more closely with the materials handling business.

Steel Buyer Service . . .

• Information compiled by Crucible Steel Company of America is included in a stock list to help steel fabricators to determine easily and quickly the immediate availability of alloy steel stocks by grades and sizes. This publication will be issued every three months to keep count on stock from coast to coast.

Enter Association . . .

• West Coast screw machine product producers are now members of the 11th district of the National Screw Machine Products Association. The 25th anniversary of the association sees coast to coast representation with Francis P. Trinkaus, president of Crellin Machine Co., as the West Coast member of the board of trustees. New NSMPA officers include C. J. Baumgart, president; Leonard R. Schaffer, vice president; and Roland G. Herker, treasurer.

Record Safety Year . . .

• Four company divisions of Westinghouse Electric Corp. received the Award of Honor from the National Safety Council. Each division has more than 3,000,000 accident-free hours of production in 1957.

Officers Elected . . .

• New president of the American Welding Society is Gustav O. Hoglund, head of the Welding Section of the Aluminum Company of America Process Development Laboratory. Charles I. MacGuffie, manager of marketing of the Welding Department of the General Electric Co., was elected first vice president.

ASTE Awards . . .

• "To promote the science of tool engineering and to encourage contributions in the immediate and related fields covered by the activities of the society," six awards were presented recently by the ASTE to these men: Lester L. Colbert, Progress Award; Jesse Daugherty, Engineering Citation; J. Everett Hollingsworth, Education Award; Dr. Max Kronenberg, Research Metal; Andrew E. Rylander, Joseph A. Siegel Memorial Award; and Dr. Milton C. Shaw, Gold Medal.

Giddings & Lewis Machine Tool Co. has purchased The Prescott Co., which will continue to manufacture sawmill machinery and diesel engines and to do machine shop contract work.

◆

In a major expansion move, the Narda Ultrasonics Corp. has acquired Alcar Instruments Inc. Alcar, to be operated as an independent subsidiary, specializes in ultrasonics research and development and supplies custom-built systems and high-powered ultrasonic equipment and special devices to industry.

◆

The purchase of Renco-Toledo, Inc., manufacturer of machine tool automation devices, by Cleveland Pneumatic Industries has been announced. The Renco line will continue to be marketed under the present trademark, "Renco-Aire."

◆

Chelsea Products, Inc. has been purchased by the Dana Corp. to further fulfill the Company's policy of diversification. Chelsea is a producer of gear boxes for the automotive, truck, farm equipment, and construction industries.

◆

To extend operations beyond the field of precious metals, Handy & Harman has acquired Posen & Kline Tube Co., Inc., makers of small diameter precision industrial tubing in stainless steel, carbon and alloy steels, and nickel and other alloys. The acquired company will operate as a wholly-owned subsidiary under the supervision of its former owners.

◆

Lovejoy Flexible Coupling Co., producer of power transmission equipment, has acquired controlling interest in Hi-Lo Mfg. Co., formerly Equipment Engineering Co. With this acquisition, Lovejoy extends its variable speed pulley line to include a complete range of cam-controlled units from fractional to 5 hp.

◆

A move to open a new market for aluminum in the electrical field was announced by Aluminum Company of America with the purchase of the Transformer Division of Automation Instruments, Inc.

drill · ream · chamfer spot-face · center · deburr

do all these operations

and more

***with the* SERIES 26**

DUMORE®

AUTOMATIC DRILL UNIT

Only **$550.*** *Complete*

Catalog No. 26-062
½ hp., 208/220 V., 50/60 cy. 3 phase, totally enclosed motor 1440/1725 rpm

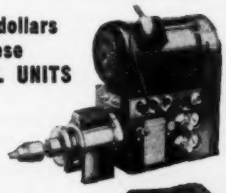
*F.O.B. Racine

This unit is a quality engineered, compact driving head for a wide variety of machining. It is fully automatic with built-in basic electrical and pneumatic controls. It is ideal for long production runs or multiple set-ups where frequent changeovers are not necessary.

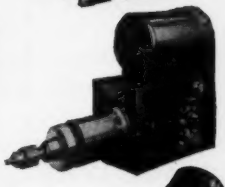
It is a powerful, versatile, all-purpose unit that lets you use it where you need it—on drill presses, fixtured set-ups, bench mounted; or added to special-purpose building-block production machines, transfer stations and other automatic machining systems. Keeps right on working on set-up after set-up!

This special Dumore nose mounting bracket is your key to all-purpose machining—*anywhere*. It permits fast, easy mounting in any position, angle or direction in single set-ups, or multiple machining operations in sequence. Changeovers, when necessary, are made quickly, speedily. Return to original set-up is equally fast!

You can save hundreds of dollars in first cost alone with these DUMORE AUTOMATIC DRILL UNITS



Series 28
"Drill-N-Tap" Unit — 2 tools in 1 at the cost of only one. Drills or taps at the flip of a switch. Tap fits into chuck, no extra head required. Reversing motor removes tap, eliminates costly clutches. 265 to 4900 rpm. For long or short runs.



Series 24
Fully automatic with all controls built-in. Preselected speeds, feeds, depths. Ideal for varying runs and frequent changeovers.

Series 20
Automatic Drill Heads for high production drilling of small parts. Stops drill breakage. Built-in controls. No. 80 to 5/32" capacity.

DUMORE® **ALL-PURPOSE PRECISION METALWORKING TOOLS**

THE DUMORE COMPANY • 1304 Seventeenth St., Racine, Wis.

VERSA-MIL • DRILL-N-TAP UNITS • DRILLING UNITS • DRILL HEADS
MICRO DRILLS • DRILL GRINDERS • TOOL POST and HAND GRINDERS
FLEX-SHAFT TOOLS • QUILLS

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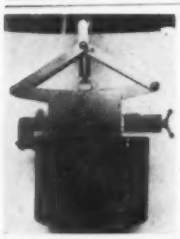

LIFTING DEVICES
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FAST • SAFE • BETTER
Material Handling
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400 MODELS

H. L. BUSHMAN CO. 100 West Central Ave. Roselle, Illinois

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DIAMOND WHEEL LINE
AVAILABLE IN RESTRICTED TERRITORIES

We are seeking expanded distribution control in all key U. S. industrial areas.

Box 758, Tooling & Production Magazine, 1975 Lee Rd., Cleveland, Ohio

Holds odd-shaped parts for faster working

The **SEVO CONTOUR VISE** has three-point mountings that reduce your set-up time. Odd-shaped parts fit this adjustable jig firmly; are easier to place accurately, easier to work, easier to remove. Use for all short-run milling, drilling, grinding, tool and die work. No parts damaged in clamping. Multiple jaws independently adjustable, positively locked by cam in any desired position. Used by large and small shops. Precision made. Four sizes: capacities, 1 ⅛", 2 ½", 5", 10". Low cost. Pays out for you over and over in time-savings. Write: DeWilde-Jones, Inc., P. O. Box 231, San Francisco 1, Calif.

Slash Your Tooling Costs 6 Ways

To save you money, Sentry Electric Furnaces with Diamond Block Atmosphere Control bring you 6 important high speed steel tool hardening advantages.

1. Low capital investment.
2. Simplicity of operation.
3. Controlled tool hardness.
4. Finishing operations eliminated.
5. Tool production increased.
6. Manufacturing tolerances improved.

Request catalog detailing further cost cutting advantages of the Sentry method. Send samples of your high speed or high carbon high chrome tools for a demonstration hardening.

304-8

Sentry TRADEMARK **ELECTRIC FURNACES**

Request Catalog L-43 Write **THE SENTRY CO., FOXBORO, MASS.**

CIRCLE INFORM-A-GRAM KEY NO. 1182

Coming Events

July 7-12. National Association of Architectural Metal Manufacturers. Second Annual Architectural Metal Institute. Northwestern University, Chicago.

•

July 14-16. Truck-Trailer Manufacturers Association. Summer Meeting, Homestead, Hot Springs, Virginia.

•

July 23-26. National Tool & Die Manufacturers Association. Summer Board Meeting. Mount Washington Hotel, Bretton Woods, New Hampshire.

•

July 24-25. Denver Research Institute, Electronics Division. 5th Annual Symposium on Computers and Data Processing. Albany Hotel, Denver.

•

July 28-Aug. 1. National Machine Tool Builders Association, and American Machine Tool Distributors' Association. Annual Sales Conference. Purdue University, Lafayette, Indiana.

•

Aug. 11-14. Society of Automotive Engineers. National West Coast Meeting. The Ambassador, Los Angeles.

•

Aug. 19-22. Western Electronic Show and Convention. Pan Pacific Auditorium, Los Angeles.

•

Sept. 8-11. Society of Automotive Engineers. Farm, Construction and Industrial Machinery Meeting, Production Forum, and Engineering Display. Milwaukee Auditorium, Milwaukee.

•

Sept. 10-11. American Die Casting Institute. Annual Meeting. Edgewater Beach Hotel, Chicago.

•

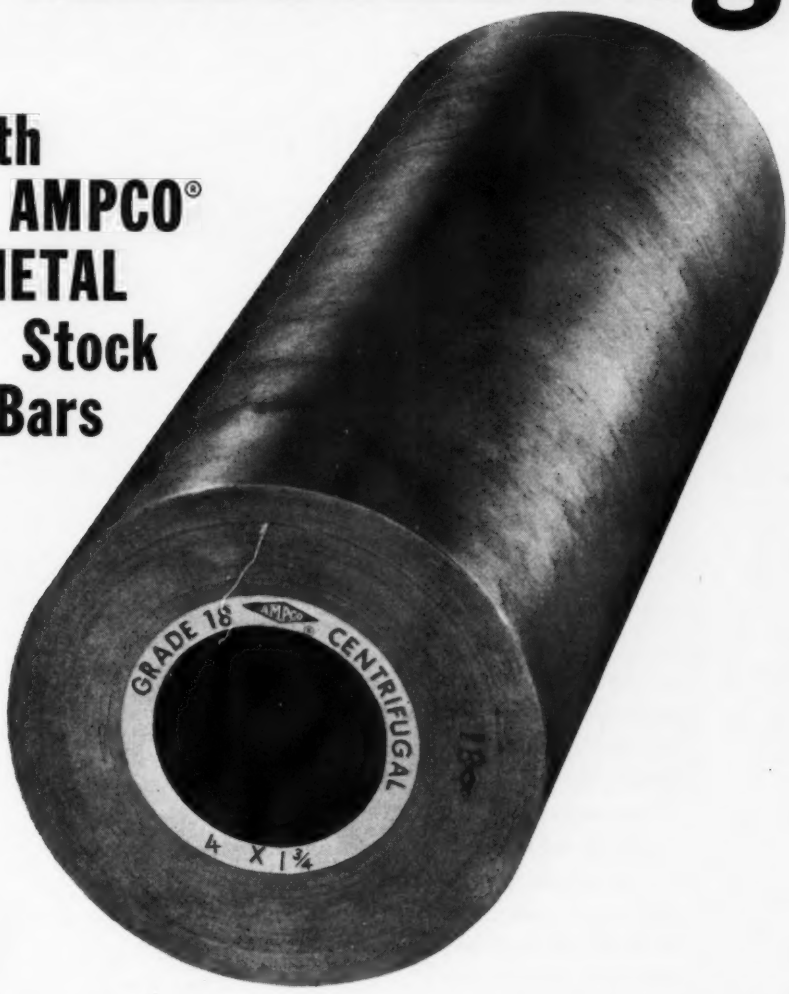
Sept. 12. Society of Plastics Engineers, Inc. Regional Technical Conference. St. Clair Inn, St. Clair, Michigan.

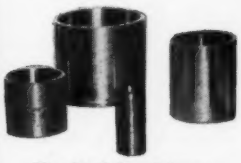
———•———

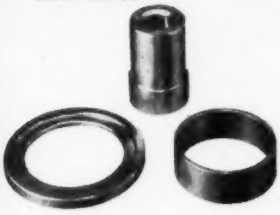
A Gear Services Department has been established by Illinois Tool Works, 2501 N. Keeler Ave., Chicago. The program offers prototype gear and product manufacturing, gear inspection and analysis, design and product engineering service, and a gear training program.

Save machining

with AMPCO® METAL Stock Bars







Typical bushings and bearings of Ampco Metal centrifugally-cast bars.

Only finish-machine cuts are needed on Ampco Metal Centrifugally Cast Stock Bars. They are semi-finish machined all over — finish allowance, 1/16" on O. D. and I. D.

Made of Ampco Metal Grade 18, a tough copper-base alloy that resists wear, shock, impact. Ideal for bearings, bushings, gears, and similar applications.

Your Ampco distributor has Ampco Metal Stock Bars in stock now — in 90 sizes up to 10" O. D. 12½" lengths. Call him for prompt delivery. *Ampco Metal, Inc., Dept. 554F, Milwaukee 46, Wis. West Coast plant: Burbank, Calif. — Southwest plant: Garland (Dallas County), Texas.*

RM-11

AMPCO

AMPCO®

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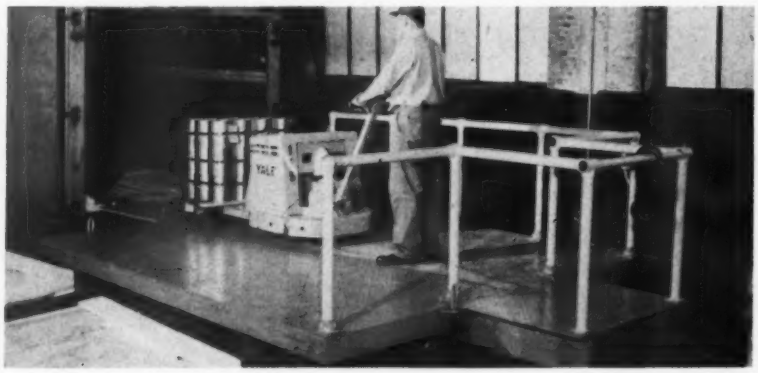
EASILY TRANSPORT MATERIALS FROM PLATFORM TO TRUCK

Lick your varying-level loading problems as easily as The American Brass Company's Buffalo, N. Y., Division did, using the Portelevator, a variable height loading dock that maintains constant level with truck beds. Operation is simple: move fork truck from platform to Portelevator loading dock, change loading dock to truck level by push-button control, and deliver the load to waiting truck. This Portelevator, manufactured by The Hamilton Tool Co., has a "pigeon-hole" (right end) for the fork truck during delivery of materials by overhead crane.

Circle Inform-A-Gram No. D1.



How-To-Do-It REFERENCE BOOKS

USE THIS PAGE AS YOUR ORDER BLANK

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HUEBNER PUBLICATIONS, INC.
1979 LEE ROAD, DEPT. C, CLEVELAND 18, OHIO

Gentlemen: Please send books checked.

___ADHESIVE BONDING OF METALS by Geo. Epstein. 227 pages. $2.95 ea.
___AMERICAN MACHINIST'S HANDBOOK 1958 Edition. 1,579 pages. 774 illus. $11.00 ea.
___BRAZING MANUAL prepared by American Welding Society. 208 pages. $4.75 ea.
___COMPUTERS by E. C. Berkeley. 376 pages. $8.00 ea.
___DETERIORATION OF METALS by G. A. Greathouse. 850 pages. $14.00 ea.
___DIAMOND TECHNOLOGY by Paul Grodzinski. 784 pages. $10.00 ea.
___DIE DESIGNING & ESTIMATING, 4th edition. 368 pages. $7.50 ea.
___ELECTROPLATING ENGINEERING HANDBOOK edited by A. K. Graham. 670 pages. $10.00 ea.
___ENGINEERING USES OF RUBBER edited by McPherson and Klemin. 490 pages. $12.50 ea.
___FASTENERS HANDBOOK by Julius Soled. 450 pages. $12.50 ea.
___GEARS FOR SMALL MECHANISMS by W. O. Davis. 20 chapters. $5.00 ea.
___HANDBOOK OF BARREL FINISHING by R. F. Enyedy. 288 pages. $8.25 ea.
___HANDBOOK OF LAYOUT AND DIMENSIONING FOR PRODUCTION by Hyman H. Katz. 479 pages. $15.00 ea.
___INDUCTION AND DIELECTRIC HEATING by J. W. Cable. 590 pages. $12.50 ea.
___INSTRUMENTS FOR MEASUREMENT AND CONTROL by W. G. Holzbock. 372 pages. $10.00 ea.
___PRINCIPLES & METHODS OF SHEET-METAL FABRICATING by Geo. Sachs. 537 pages. $11.00 ea.
___PROTECTIVE COATINGS FOR METALS by Burns and Bradley. 657 pages. $12.50 ea.

10-day examination allowed; returnable for full credit or refund if returned in saleable condition.

TOTAL AMT. OF ORDER $_____

Open account shipments to rated companies. Otherwise payment with order, please. No C.O.D's. Ohio customers add 3% sales tax. Quantity prices quoted on request.

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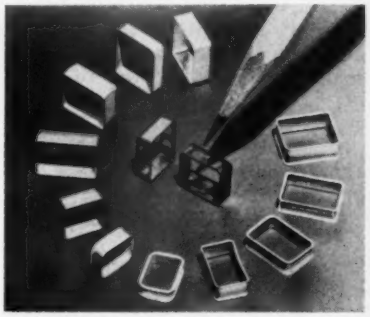
ANODIZED MOVING COIL FORMS FOR METERS VOLUME-PRODUCED

Volume production of precisely dimensioned moving coil forms for d'Arsonval galvanometers has been evolved by a company that specializes in metal tubular parts and, through experience, has developed completely integrated production facilities. Plant operations include precise redrawing of tubing and accurate manufacture of required tools and dies as well as processing and, if desired, anodizing of coil forms on a production line basis.



Finished forms are produced in a variety of sizes and shapes, weighing as little as one grain (1/480 oz). Tolerances as close as ±0.0002" can be obtained on wall thicknesses which range in size from 0.003" to 0.010". Tolerances on other dimensions can be within ±0.001" as specified by the user.

H&H Machine Co., the developer, has its own anodizing techniques to coat the coil forms for corrosion resistance and dielectric strength. Anodized coating can be dyed blue, violet, red, copper, or gold so that the user can distinguish forms differing only slightly in size. The anodized forms meet 250 or 500-volt dielectric strength tests. For greater dielectric strengths, forms can be coated with Teflon.

Standard material for the forms is ultra-high purity aluminum (99.8% with 0.015% maximum iron content). Other materials, such as type 2S or 52S aluminum, as well as copper or brass, are supplied also on request.

———•———

The Electro Minerals Div'n of The Carborundum Co. has opened a Product Development Laboratory for evaluating the effect of process changes on product quality. It provides pilot plant facilities for developing the manufacturing processes required for new products and the improvement of processes used in existing plants.

DRexel 6-4222 ESTABLISHED 1927

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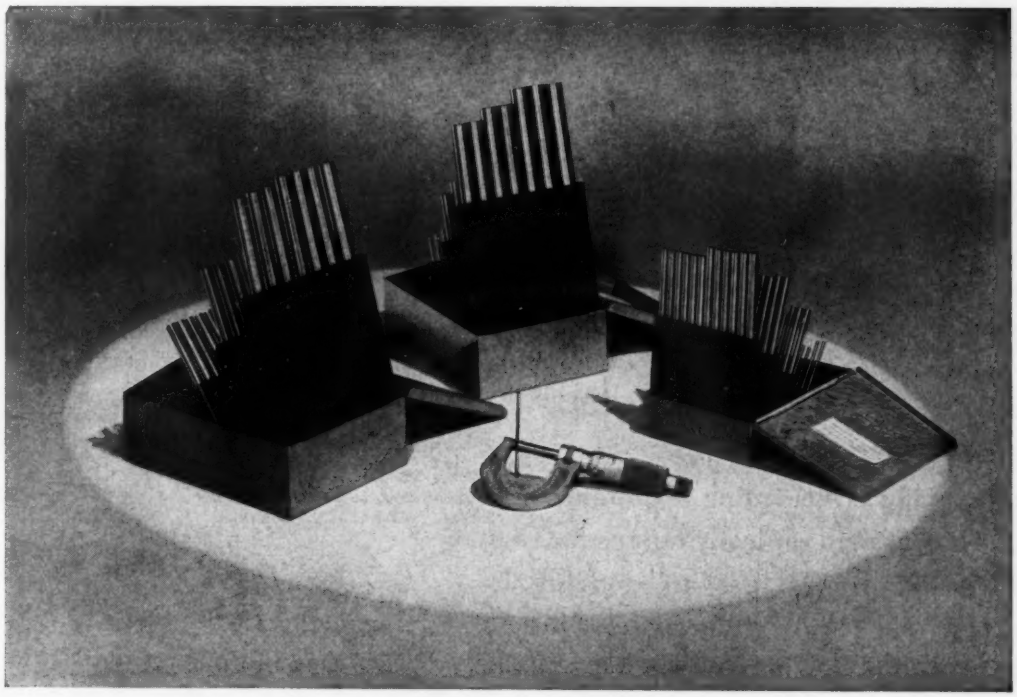

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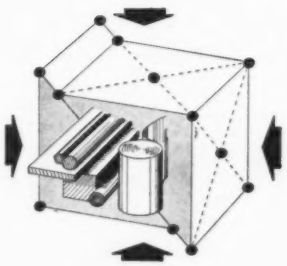

. . . Roll Planish

by Harlan L. Meredith
Vice President
AIRLINE WELDING AND ENGINEERING
Hawthorne, California

Roll planishing is becoming a popular weld helper. It is used to radically reduce the high cost of shielded inert gas arc welding by eliminating the use of filler wire. It is a simple, versatile, and practical *cold working* process which can be done at a moderate cost.

THE MOST DESIRABLE APPROACH to any joining process is the simplest and least expensive method. Fusion welding is probably the least expensive, but often the question *is*: Will simple joints satisfy the design requirements? Planishing makes them satisfy.

The simplest joint form is the square butt joint which is normally joined with the addition of filler wire; as a matter of fact, most weld joints are joined with the addition of filler wire. However, for fabricating sheet metal parts, by fusion welding,

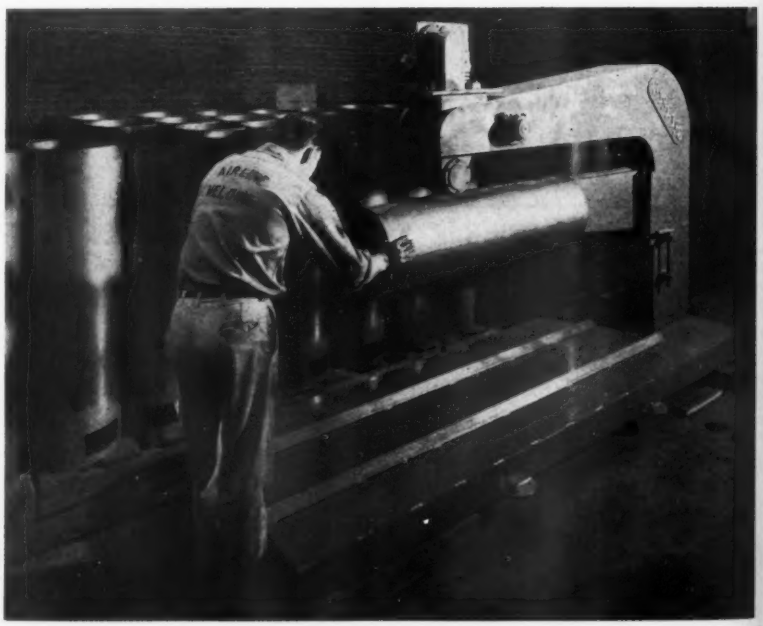

Fig. 1. Roll planishing with controlled pressure on a 10-ton planisher. The weld area is compressed between formed opposed rolls to smooth and strengthen it.

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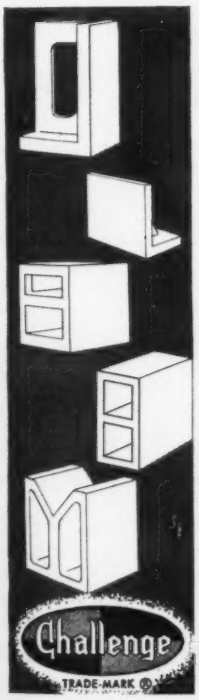

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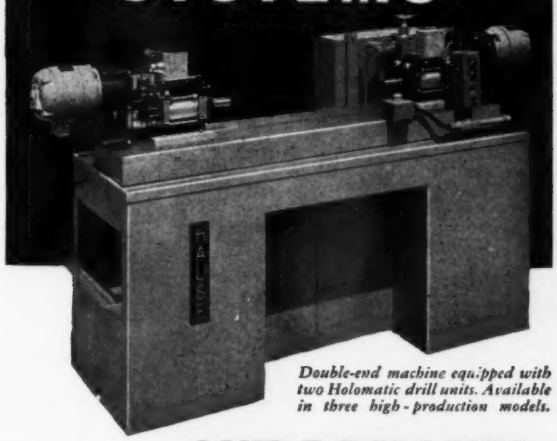

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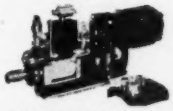

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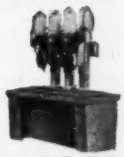

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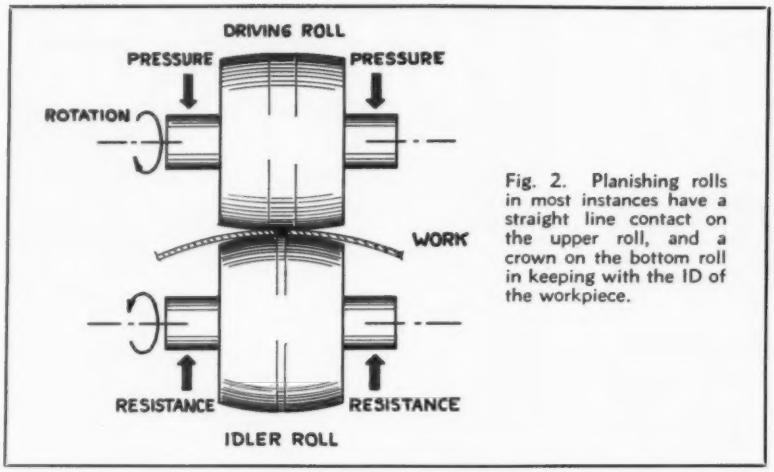

Fig. 2. Planishing rolls in most instances have a straight line contact on the upper roll, and a crown on the bottom roll in keeping with the ID of the workpiece.

there are three distinct types of weld joints which can be made *without* the addition of filler wire. They are: (1) the square butt, (2) the corner joint, and (3) the standing edge. These joints do not require filler metal under the following conditions: (1) where the weld thickness shall be the same as the base metal, (2) where the joint strength shall be equal to the base metal strength, and (3) where the welded area should be smoothed by some means other than grinding or machining. The method for accomplishing and satisfying these three conditions is to "fuse" weld the joint and then roll planish.

The roll planishing process is for flattening and smoothing the as-welded joint, and to *cold work* the metal to improve its mechanical properties. Typical equipment used for planishing is shown in Figure 1. This 10-ton planisher accomplishes its job by compressing the weld between opposed hardened rolls — the basic relationship of the planishing rolls is shown in Figure 2. The upper roll is driven by a suitable power unit and exerts a down pressure that is resisted by the lower roll. Extremely high or very low pressure can be exerted by a pneumatic controllable lever arm.

The shape or contour of the rolls depends upon the general usage of the planisher. If thin walled cones or cylinders have been "fuse" welded, it is necessary to push the "drop thru" up into the weld joint, at the same time correcting the concave condition. This operation is usually done with the upper roll having a straight line contact normal to its axis while the lower roll has an appropriate crown.

Many interesting facts about the effects of roll planishing welded butt joints have been resolved from tests made on welded planished specimens. Tables 1 and 2 summarize the results of two tests. In each case, a comparison between the strength of the as-welded joint and the planished-weld joint was made.

The Nimonic 75 (a super alloy) tests showed that regardless of the weld joint condition, *tensile failure always occurred in the base metal* outside of the weld joint. There was no significant difference between the ultimate tensile strength of the as-welded joint and the roll planished joint. *However*, a significant change in the yield strength and the elongation across the joint did occur. Roll planishing improved the yield strength by approximately 2,500 psi; this increase in yield was accompanied by a 62% decrease in elongation across the joint metal. These results were very gratifying as they pointed out that roll planishing not only removed the concavity but also toughened the weld metal so that failure would *never* occur there, in the planished region.

TENSILE TEST

PURPOSE: TO DETERMINE THE EFFECT OF ROLL PLANISHING INERT-ARC WELDED BUTT JOINT ON NIMONIC 75 "SUPER ALLOY" SHEET.

MATERIAL: NIMONIC 75 (PWA 673) .060" SHEET

AS-WELDED LAB TEST 96-509

SPEC. NO.	ULTIMATE F_{TU} (PSI)	YIELD F_{TY} (PSI)	ELONGATION 2 IN.	ELONGATION .5 IN.	FRACTURE
W-2-10	110,548	58,227	28.0	22.0	PLATE
W-2-11	110,638	60,857	28.5	24.0	PLATE
W-2-12	110,212	59,574	28.0	24.0	PLATE
AVERAGES	110,466	59,550	28.1	24.3	PLATE

ROLL PLANISHED LAB TEST 96-508

P-1-10	111,496	65,075	25.0	12.0	PLATE
P-1-11	109,936	62,156	25.0	10.0	PLATE
P-1-12	110,736	61,894	24.0	6.0	PLATE
AVERAGES	110,722	63,041	24.6	9.3	PLATE

Table 1. Tensile tests comparing as-welded and planished specimens of a "super alloy".

The results of tensile tests conducted on welded and planished joints in type 316 stainless steel were even more gratifying, as shown in Table 2. These tests pointed out that the as-welded joint, was considerably weaker than the base metal, since failure always occurred in the center of the weld. And, elongation across the weld was nearly 12% greater than at any other part of the 2" test strip. This rubber-like tendency of the weld could not be attributed to a thinner cross-sectional area since examination showed the center to be just as thick as the base metal. After roll planishing however, these conditions were corrected, and the ultimate tensile strength was increased by more than 3000 psi. As you can see the yield strength was also increased. Contrary to the results obtained on the Nimonic 75 tests, the elongation in the 2" strip was increased from 29% to 48%; this

TENSILE TEST

PURPOSE: TO DETERMINE THE EFFECT OF ROLL PLANISHING INERT-ARC WELDED BUTT JOINT IN STAINLESS STEEL.

MATERIAL: TYPE 316 CRES. .039" SHEET (ANNEALED)

AS-WELDED LAB TEST 96-505

SPEC. NO.	ULTIMATE F_{TU} (PSI)	YIELD F_{TY} (PSI)	ELONGATION 2 IN.	ELONGATION .5 IN.	FRACTURE
W-2-11	81,660	46,712	27.5	40.0	WELD
W-2-12	81,514	46,302	29.0	40.0	WELD
W-2-13	82,692	47,552	30.0	42.0	WELD
AVERAGES	81,955	46,855	28.8	40.7	WELD

ROLL PLANISHED LAB TEST 96-1504

P-1-10	84,083	47,368	50.5	32.0	SHEET
P-1-11	85,467	48,615	46.0	26.0	SHEET
P-1-12	85,191	50,522	48.0	28.0	SHEET
AVERAGES	84,913	48,835	48.1	28.0	SHEET

Table 2. Tensile test comparing as-welded and planished specimens of stainless steel.

radical change was caused by the 13% decrease in the elongation across the weld; planishing had toughened the weld metal and consequently forced the adjacent base metal to neck down at a faster rate. As a result of this "about face" *all failures occurred in the base metal.*

Although the test results published here concern special alloys, it should be noted that the roll planishing process can be used advantageously for planishing most metals that can be welded. end

Please refer to your October '57 issue of TOOLING & PRODUCTION, page 93, for more detail on the metallurgical phenomena that takes place during roll planishing. Also on page 120 of the same issue, roll planishing was briefed.

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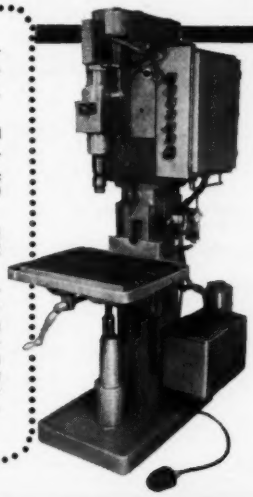

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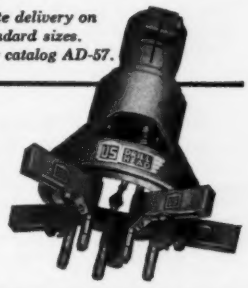

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CENTER-DRIVE LATHE WITH UNIQUE TOOLING REPLACES TWO LATHES

Machining forged steel crankshafts at Caterpillar is a highly important operation because a heavy portion of the company's reputation is pinned to the performance of these units in the concern's diesel engines for marine, industrial, and electric set applications, as well as prime power for tractors, motor graders, and earth-moving equipment.

To meet its needs, the company processes in the same department crankshafts in 11 sizes — and types ranging from 4 to 6 throws.

Until recently, these forged steel units were handled on two machines — a center-drive lathe for turning bearings, flanges and stub ends, and a double-end-drive machine for turning all remaining intermediate bearings. Tooling these machines was time consuming, and accuracy of the setups, which involved as many as 33 cutting tools, hinged on the abilities of two operators, one at each machine.

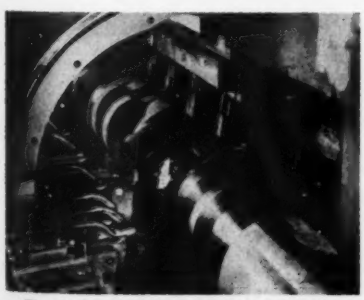


Fig. 1. Rugged gang tools enable the Wickes automatic to cheek, turn and fillet all bearings, flanges, and stub ends of a crankshaft simultaneously.

Today, forged steel crankshafts are handled on only one machine — a Wickes double-housing, 36" center-drive bearing lathe. The machine needs the services of one operator.

The huge 505-lb forged steel crankshaft shown in Figure 1 is typical of the work being done at Caterpillar.

Shifting to another type and size crankshaft is no problem. Retooling consists simply of removing a special mounting plate, which holds the necessary cutting tools, and remounting another. These mounting plates are all pretooled for each type and size crankshaft to be machined and are stocked in the tool crib.

Crankshafts are spotted for the machine by a floor conveyor running parallel and in front of the machine. The work is lifted by crane and placed on the loading rack at the right of the Wickes automatic. The pushbutton controlled hydraulic loader unloads from the left, and picks up from the right (Fig. 2).

Fig. 2. Some 67 lbs of metal is removed from this 505-lb forged steel diesel engine crankshaft.

Once in the machine, the crankshaft is chucked on previously milled spots and turned at speeds from 18 to 24 rpm. Tool life with the special high-speed form tools used ranges from 10 to 50 crankshafts.

One of the features of the machine is its feeds. After initial manual adjustment they compensate automatically to meet whatever metal hardness condition is encountered in various lots of crankshafts, or for changed crankshaft specifications.

CUMULATIVE EDITORIAL INDEX FOR 1958 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

SUBJECT INDEX

Abrasives, coated, performance factors of, Jan. p. 87 (4 pp)

Adhesives
Bonding, for carbide tip attaching to steel, Apr. p. 83.

Alloys, high temperature, formed by high-impact-spin technique, Jan. p. 78 (4 pp)

Assembly (also see Welding, etc.)
Facilities for stamped components, Apr. p. 87 (4 pp)

ASTE Tool Show
Technical Conferences, Apr. p. 96 (2½ pp)
Tool show previews, Apr. p. 100 (8 pp)

Automation line, tape controlled, Apr. p. 94 (2 pp)

Bearings
Bushings, pilot, live roller, Mar. p. 65 (3 pp)
Inventory, reduction of, Mar. p. 73 (1½ pp)
Life, improvement of, Mar. p. 74 (¾ p)

Boring
Heavy parts, setup for, Apr. p. 71 (4 pp)
Jig, horizontal, Mar. p. 57 (4 pp)

Brazing
Carbide tip attachment to steel by, Apr. p. 85
Honeycomb fabrication by, Jan. p. 73 (4½ pp)

Bushings, pilot, live roller, Mar. p. 65 (3 pp)

Carbide
Drills, application and maintenance of, Apr. p. 75 (5 pp)
Milling steel on low-horsepower machines, Feb. p. 83 (5 pp)
Pilot bushings for improved life, Mar. p. 65 (3 pp)
Throwaway insert standards, Feb. p. 79 (2½ pp)
Tips, methods for attaching to steel shanks, Apr. p. 83 (4 pp)
Tools, diamond grinding wheels for, Feb. p. 67 (12 pp)
Tools, new cutting materials for, Feb. p. 88 (5 pp)
Tooling, throwaway insert control, Feb. p. 79 (2½ pp)

Coated abrasives, performance factors of, Jan. p. 87 (4 pp)

Cold forming
High temperature alloys, Jan. p. 78 (4 pp)
Importance to Industry, Apr. p. 8 (2 pp)
Splines by low pressure rolling, June, p. 52 (1 p)

Contour projectors for production and inspection, Mar. p. 75 (2 pp)

Contouring, numerical control, vs. tracer control, Jan. p. 72 (½ p)

Control
Centralized, by production monitoring system, June, p. 45 (2 pp)
Electronic, for grinding needle bearings, Apr. p. 91 (2 pp)
Tape, for multi-station job-lot automation, Apr. p. 95 (2 pp)
Tracer vs. numerical control, Jan. p. 72 (½ p)

Conveyor, roller, use of, Apr. p. 71 (4 pp)

Coolants for diamond wheels, Feb. p. 67 (12 pp)

Cost cutting
Automatic programming for turret lathes, June, p. 49 (2 pp)
Parts identification, rubber stamps vs silk screen, June, p. 37 (3½ pp)
Plant-wise production control, for June, p. 45 (2 pp)
Univac integrates order processing, June, p. 123 (½ p)

Cutting tools
Carbide drills, sharpening of, Apr. p. 75 (5 pp)
Carbide insert milling cutters for low-horsepower machines, Feb. p. 83 (5 pp)
Gun drill applications, Jan. p. 67 (5¼ pp)
Materials, metallurgy of, Feb. p. 88 (5 pp)
Milling cutters, determining approach and runout of, Apr. p. 80 (3 pp)

Design clinic
Milling cutter for blind hole keyways, June, p. 41 (3¼ pp)

Diamonds, special report, use and conservation of, Feb. p. 67 (12 pp); correction of, Mar. p. 69 (1 p)

Dies
Progressive and transfer for high production, May, p. 66 (2¾ pp)

Dividing head, for measuring, 1/10th sec. of arc, June, p. 51 (1 p)

Drilling, gun application of, Jan. p. 67 (5¼ pp)

Drills
Carbide twist, application and maintenance of, Apr. p. 75 (5 pp)
Radial, for heavy work boring, Apr. p. 71 (4 pp)

Electronic machine, future application of, Mar. p. 51 (1 p)

Extruding metals, four methods for, Apr. p. 8 (2 pp)

Feeds and speeds for diamond wheels, Feb. p. 67 (12 pp)

Flatness, surface plates, measurement of, May, p. 69 (4½ pp)

Fusion: a carbide tip attachment method, Apr. p. 86.

Gage blocks, creation, development, manufacture of, May, p. 63 (3 pp)

Gages
Automatic, for in-process control, May, p. 57 (5 pp)
Electronic, caliper for measuring in millionths, June, p. 47 (2 pp)
Gun Drill, construction of, Jan. p. 67 (5¼ pp)

Grinding and finishing
Angular grinding on surface grinders, Feb. p. 82 (1 p)
Control, continuous grinding, Apr. p. 91 (2 pp)
Diamond wheels for, Feb. p. 67 (12 pp)
Finish, checking smoothness of, Mar. p. 56 (1 p)
Gun drill cutting edges, Jan. p. 67 (5¼ pp)
Repetitive grinding to ±0.000010", June, p. 47 (2 pp)
Twist drills, carbide, Apr. p. 75 (5 pp)

Gun drilling, application of, Jan. p. 67 (5¼ pp)

Hole punching by grid layout, Jan. p. 110 (½ p)

Honeycomb sandwich structures, fabrication of, Jan. p. 73 (4½ pp)

Inspection
Contour projection for, Mar. p. 73 (1½ pp)
Data for determining machine capability, May, p. 51 (2½ pp)
Finish, checking smoothness of, Mar. p. 56 (1 p)

Interferometers, accurately measuring millionths with, May, p. 63 (3 pp)

Inventory, bearings, reduction of, Mar. p. 73 (1½ pp)

Jig boring, horizontal, Mar. p. 57 (4 pp)

Jigs and fixtures
Fixtures, trunnion, for heavy parts, Apr. p. 71 (4 pp)

Keyways
Blind hole, milling cutter for, June, p. 41 (3¼ pp)

Lathe
High precision headstock for, Jan. p. 82 (2 pp)

Turrett, automatic programming for, June, p. 49 (2 pp)

Machines
Capabilities, determination of, May, p. 51 (2½ pp)

Machine tools, replacement of, Feb. p. 65 (1 p)

Machining (also see specific process)
Horizontal jig boring, Mar. p. 57 (4 pp)

Management
Idle dollars, opportunities for, May, p. 49 (1 p)
Responsibilities delegated by, Mar. p. 53 (2½ pp)
Tomorrow's opportunities, planning for, May, p. 28 (1½ pp)
Training, effective pre-requisite for, June, p. 131 (2 pp)
Winning friends and influencing P.A.'s, June, p. 35 (1 p)

Materials
Cutting metals, evaluation of, June, p. 23 (1¾ pp)
Cutting tools, metallurgy of, Feb. p. 88 (5 pp)
Extruding, savings by, Apr. p. 8 (2 pp)

Measurement methods
Measuring 1/10th sec. of arc, dividing head for, June, p. 51 (1 p)
Standards for, May, p. 63 (3 pp)

Milling
Blind hole keyways, tooling for, June, p. 41 (3¼ pp)
Cutter approach and runout, determination of, Apr. p. 80 (3 pp)
Cutters, carbide inserts for low-horsepower machines, Feb. p. 83 (5 pp)
Machines, live bearings for, Mar. p. 65 (3 pp)

Numerical control, application of, Mar. p. 84 (1 p)

Parts identification, rubber stamps for, June, p. 37 (3½ pp)

Plastic tooling, increased use of, Mar. p. 70 (1½ pp)

Presses
Automatic, for high production, Mar. p. 68 (1 p)
Automatic with transfer die, May, p. 66 (2¾ pp)
Transfer, for deep drawing, Apr. p. 93 (1 p)

Production control
Plant-wise, for cost cutting, June, p. 45 (2 pp)

Programming
Automatic, for turret lathes, June, p. 49 (2 pp)

Quality control
Automakers examine quality control results, May, p. 54 (1½ pp)
Automatic gaging for, May, p. 57 (5 pp)
Machine capabilities, determination of, May, p. 51 (2½ pp)
Planning and training for, May, p. 55 (½ p)

Radial drill for heavy work boring, Apr. p. 71 (4 pp)

Research, industrial, evaluation of, Jan. p. 8 (3 pp)

Salvage, diamonds, program for, Feb. p. 67 (12 pp)

Small business, technical assistance for, Jan. p. 8 (3 pp)

Soldering, low temperature, carbide tip attachment method, Apr. p. 84

Speeds and feeds for carbide twist drills, Apr. p. 77

Spindles, precision, analysis of, Jan. p. 84 (2½ pp)

Spline rolling, advantages of, Apr. p. 22

Stampings
Assembled for complete units, Apr. p. 87 (4 pp)

Stamps, rubber, for parts identification, June, p. 37 (3½ pp)

Standard units form special stud driving machines, Mar. p. 78 (2 pp)

Standards for carbide throwaway insert tools, Feb. p 79 (2½ pp)

Steel, stainless, failure of, Mar. p. 55 (½ p)

Stud driving machines, special, from standard units, Mar. p. 78 (2 pp)

Surface plates, determining flatness of, May, p. 69 (4½ pp)

Technology of this age, Feb. p. 22 (2½ pp)

Titanium, hot forming of, Jan. p. 172 (¾ p)

Tools
Jig boring, setup for, Mar. p. 57 (4 pp)
Precision, calibration of, May, p. 69 (4½ pp)
Toolmakers' square, Apr. p. 69 (1 p)
Wrenches, torque, for valve assembly, May, p. 62 (1 p)

Training
Effective, pre-requisite for, June, p. 131 (2 pp)
Plastic tooling in, Mar., p. 70 (1½ pp)

Trunnion fixture for heavy work handling, Apr. p. 71 (4 pp)

Welding
Arc, automatic machines for, Mar. p. 61 (3½ pp)
CO_2, for die set construction, Mar. p. 71 (1½ pp)
Mechanized continuous welder, portable, with controlled travel, May, p. 56 (1 p)
Projection for assembly fastening, Apr. p. 90
Spot and seam, for honeycomb fabrication, Jan. p. 73 (4½ pp)

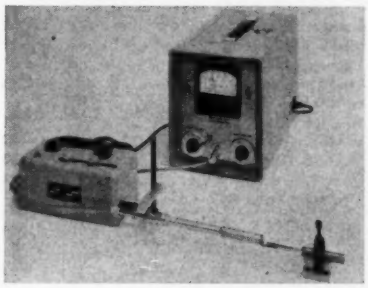
Wheel trueing tools, diamond, special report on, Feb. p. 67 (12 pp); correction of, Mar. p. 69 (1 p)

Wrenches, torque, for valve assembly, May, p. 62 (1 p)

PRODUCTION CHECK 1/8" ID'S WITH NEW PROFILOMETER GROUP

Micrometrical Manufacturing Co.'s new Profilometer Group III makes it possible to check surface roughness on ID's and OD's as small as ⅛", flats, tapers, and narrow splines. It provides roughness width cut-off selection of 0.010", 0.030", and 0.100".

The setup's QC amplimeter shows arithmetical or rms average roughness height, as selected by a switch on a panel. It has six ranges — 0 to 3, 10, 30, 100, 300, and 1000 micro-inches, and gives dependable, constant readings after a 30-sec warmup.



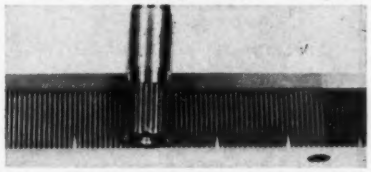
The Type V Mototrace used with Profilometer Group III gives smooth, steady tracing motion, with a tracing speed of 0.3 ips. It also gives quick reversals over any desired length of trace from 1/16" to 2¾". Manual tracing equipment is optional with the Group III Profilometer.

Circle Inform-A-Gram No. D2.

NEW ROTO-FLO METHOD ROLLS FOOLPROOF SPLINES

In many cases, product design calls for splined parts with one or more teeth wider than normal for "one-way assembly" to insure correct index alignment. A simple method for producing such foolproof splines has been developed by Michigan Tool Company, in connection with its Roto-Flo process of cold rolling toothed parts.

As shown here, the double-width index-locating tooth is produced simply by grinding off the ends of those teeth in the forming rack which would normally produce the space between two teeth at the locating point. This results in a double-width locating tooth end, which not only visually locates but mechanically assures the desired assembly engagement.



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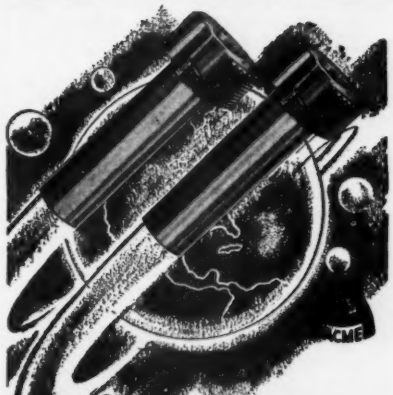

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ADVERTISERS' INDEX

Ace Drill Bushing Company 62
Acme-Danneman Co., Inc., Danneman Die-Set Division 108
Acme Industrial Co. 127
Acme Tool Corp. 96
Aget Manufacturing Co. 99
Air-Mite Devices, Inc. 84
Alina Corporation 107
Allegheny Ludlum Steel Corp. 115
Aluminum Co. of America 21
Alva Allen Industries 107
American Drill Bushing Co. 132
American Optical Co. 56
Ampco Metal, Inc. 119
Armstrong Bros. Tool Co. 104

Balas Collet Mfg. Company 7
Bald Eagle Corporation 78
Bausch & Lomb Optical Co. 105
Bellows Company 57
Benchmaster Mfg. Company 65
E. W. Bliss Co. 3
The Bodine Corporation 29
Brown & Sharpe Mfg. Co. 8
H. L. Bushman Co., Inc. 118

Cadillac Gage Co. 82
Challenge Machinery Company 123
Chicago Tool & Engrg. Company 102
Cincinnati Milling Machine Co., The 51
Cleveland Twist Drill Co. 67
Commander Mfg. Co. 104
Comtor Company 104
Conical Tool Company 103
Lawrence H. Cook, Inc. 101
Cosa Corp. 6
Cratex Mfg. Co. 104

Danneman Die Set Div., Acme-Danneman Co., Inc. 108
Delta Power Tool Div., Rockwell Mfg. Co. 14
Detroit Power Screwdriver Co. 88
Detroit Reamer & Tool Co. 78
Detroit Stamping Co. 89
Detroit Testing Machine Co. 100
DeVlieg Microbore, Div. DeVlieg Machine Co. 17
DeWilde-Jones, Inc. 118
The DoAll Company 64
Ernest F. Donley's Sons, Inc. 101
Drillmation Company 86
Dumore Company 117
Durable Punch & Die Co. 74
The Dykem Company 103

Eastman Kodak Co. 25
Eisler Engineering Co., Inc. 86
Enterprise Machine Parts Co. 102
Erickson Tool Co. 32

Fellows Gear Shaper Co. 18
Fenn Manufacturing Co. 66
Firth Sterling, Inc. 23
Flick-Reedy Corp., Miller Fluid Power Div. 15
Foster Supplies Company 95
Freeland Gauge Co. 99
The Frick-Gallagher Mfg. Co. 27

Gaertner Scientific Corp. 96
Gage Company 90
Galland-Henning Mfg. Co., Nopak Div. 9
Gallmeyer & Livingston Co. 31
Genesee Mfg. Co. 84
Graphic Systems 96
Greenlee Brothers 55

Hamilton Tool Company 83, 85
Hardinge Brothers, Inc. 113
Hartford Special Machinery Co. 60
Hause Engineering 123
Heimann Mfg. Company 101
Hevi Duty Electric Co. 94
Hill Acme Company 90, 114
Hi-Shear Rivet Tool Co. 106
Horberg Gage Company 89
Huebner Publications, Inc. 101, 120, 130
Wm. T. Hutchinson Co. 121
Hydraulic Press Mfg. Co. 71

Ideal Industries, Inc. 89
Industrial Tectonics, Inc. 111

Jergens Tool Specialty Co. 111
C. E. Johansson Gage Co. 81
Jones & Lamson Machine Co. 34

ADVERTISING REPRESENTATIVES

CHICAGO 1: Robert R. Pierson, 333 N. Michigan Ave., FRanklin 2-4811

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Kaufman Mfg. Co. 125
Kenco Mfg. Co. 100
Kidde Precision Tool Corp. 86, 103

Lapeer Mfg. Co. 90
Lectroetch Co. 22
K. O. Lee Co. 102
Lepel High Frequency Labs., Inc. 70
Lodding, Incorporated 80
Lucas Milhaupt Engineering Co. 129

Maxwell Industries, Inc. 97
Mayline Company 106
Mead Specialties Company 111
Melin Tool Company 87
W. F. Meyers Co., Inc. 99
Micromatic Hone Corp. 12, 13
Micrometrical Mfg. Co. 54
Miller Fluid Power Div., Flick-Reedy Corp. 15
Monroe Engineering Products 93
Montgomery & Co. 109
Moore Special Tool Co., Inc. 63
Robert E. Morris Co. 76

Neise, Karl A., Inc. 98
A. H. Nilson Machine Co. 16
Northwestern Tools, Inc. 75

Ohio Knife Company 69
O'Neil-Irwin Mfg. Co. 28

Perkins Machine Company 24
The Pipe Machinery Co. 11
Portage Double-Quick Tool Co. 109
Porter Precision Products 79
Potter & Johnston Company 52
Producto Machine Company 78

Reid Bros. Co., Inc. 59
Reid Tool Supply Co. 97
J. A. Richards Company 97
Omer E. Robbins Co. 92
Rockwell Mfg. Co., Delta Power Tool Div. 14

Sales Service Machine Tool Co. 91
George Scherr Co. 106
Geo. T. Schmidt, Inc. 90
The Sentry Company 118
Service Machine Company 97
Shell Chemical Corp. 73
Shore Instrument & Mfg. Co. 103
Silber Products, Inc. 101
R. L. Spellman Co. 93
Standard Tool & Mfg. Co. 129
Stebar Co. 109
P. A. Sturtevant Co. 95
Superior Steel Products Corp. 58
Sutton Tool Co. 2

The Tannewitz Works 93
C. B. Teeter 98
Thriftmaster Products Corp. 75
Tomco Products Co. 95
Torrington Mfg. Co. 68
Twentieth Century Mfg. Co. 127

United States Diamond Wheel Co. 4, 118
United States Drill Head Co. 125
U. S. Tool Co., Inc. 26
Universal Engineering Co. 30

Vascoloy-Ramet Corp. 5
Vernon Devices, Inc. 102
Verson Allsteel Press Co. 131
Vulcan Tool Co. 20, 75

Wales-Strippit Co. 10
Walls Sales Co. 78
The Walton Company 111
Ward Machinery Co 93
Wardwell Mfg. Co. 95
Watts Brothers Tool Co. 86
Weldon Tool Co. 61
Wells Mfg. Co. 123
West Point Mfg. Co. 77
Western Tool & Mfg. Co. 101
Wetmore Tool Engrg. Co. 78
S. B. Whistler & Sons, Inc. 84
Wilton Tool Mfg. Co., Inc. 98
Woodson Tool Co. 81

Yoder Company 81

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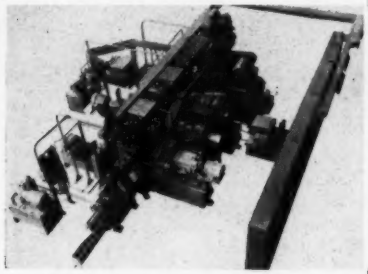

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4. Right hand horizontal head that drills four holes to 9/16" dia and reams two holes drilled in the previous station. The left hand side is idle.
5. Idle.
6. Left hand horizontal head that spotfaces six holes to 1.690" dia; and a right hand horizontal head that drills four holes to 9/16" dia.
7. Left hand head to spotface the remaining four holes to 1.690" dia while the right head is idle.
8. Right hand horizontal head that mills five lock notches with a special milling cutter.
9. Idle.
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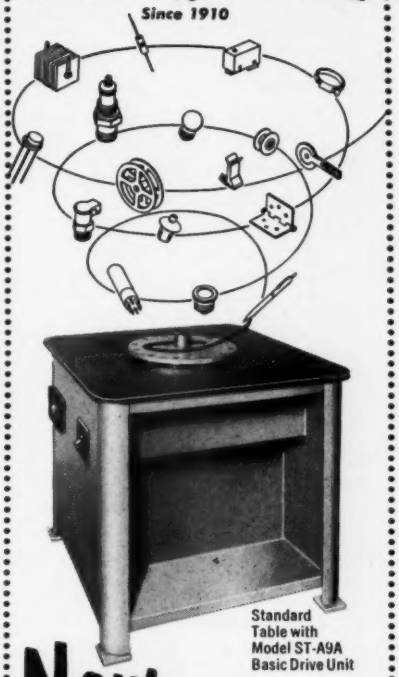

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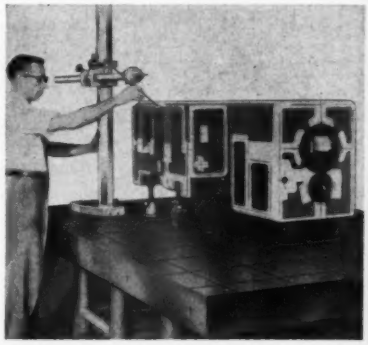

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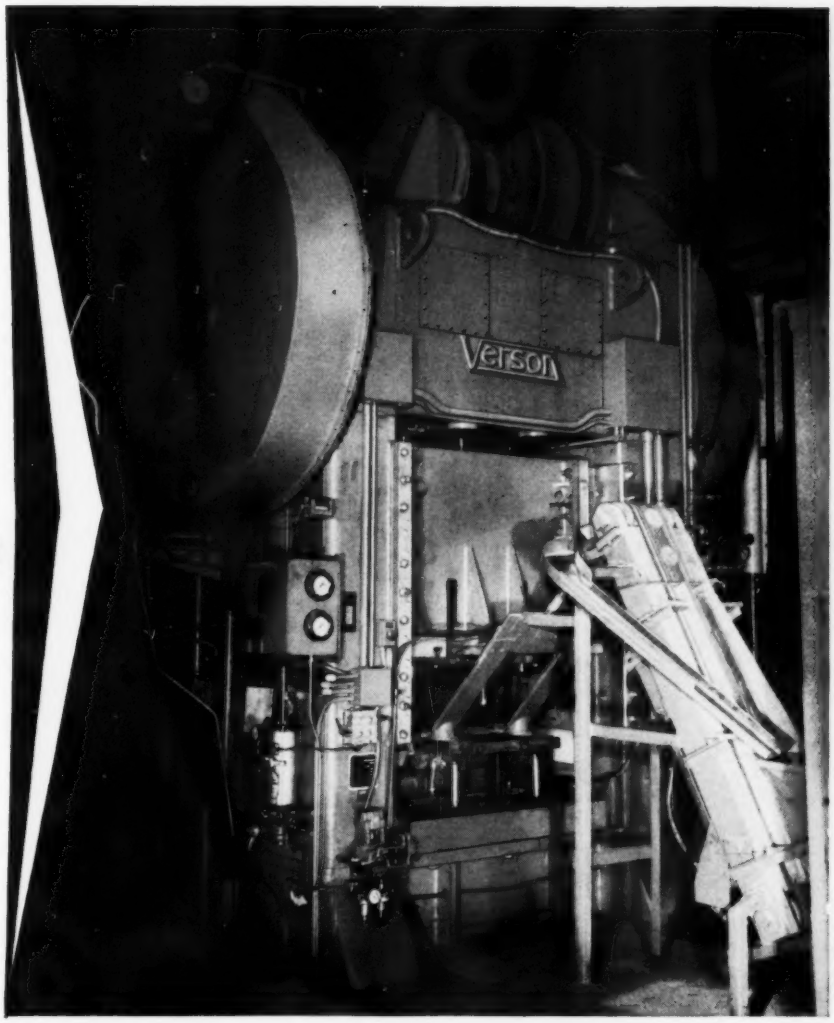

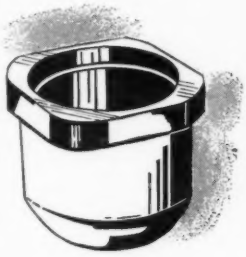

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